NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE USE OF DECISION SUPPORT SYSTEMS TO INNOVATE THE PROCESS OF CONTRACTING FOR GOODS AND SERVICES AT THE MARINE CORPS EASTERN RECRUITING REGION REGIONAL CONTRACTING OFFICE

by

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**THE USE OF DECISION SUPPORT SYSTEMS TO INNOVATE THE PROCESS
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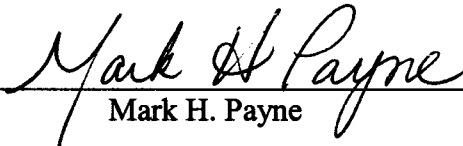B.B.A., University of Mississippi, 1996

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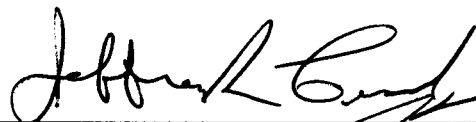
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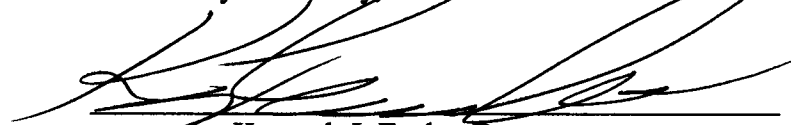
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ABSTRACT

Process innovation combines a process view of business with the application of innovation to effect order-of-magnitude improvement in performance. In order to gain the order of magnitude change that is required for process innovation, the key processes must be redesigned from beginning to end using all the innovation techniques and resources available to an organization. A knowledge-based decision support tool called KOPeR-Lite was developed to assist Business Process Reengineering (BPR) novices in process innovation. KOPeR-Lite utilizes knowledge gained from BPR experts and the literature to perform measurement-driven inference. Such inference is used to interpret empirical measurements, diagnose process pathologies and match such diagnoses with appropriate transformations. This research assesses the effectiveness of process innovation techniques by examining the relative performance of BPR novices who use KOPeR-Lite with that of novices who do not use this system. Based on the results this research then employs KOPeR-Lite along with Davenport's innovation framework to redesign the process of contracting for goods and services at the Marine Corps Eastern Recruiting Region Regional Contracting Office. If implemented, the proposed redesigns offer considerable promise to improve the efficiency and effectiveness of the contracting process.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACS   Automated Contracting System
ARS   Automated Requisitioning System
BPR   Business Process Reengineering
CBD   Commerce Business Daily
CRU   Central Receiving Unit
DB   Database
DFAS   Defense Finance Accounting Service
DOD   Department of Defense
DSS   Decision Support System
DSSC   Direct Support Stock Control
E-mail   Electronic Mail
ERR   Eastern Recruiting Region
Fund Admin.   Fund Administrator
IT   Information Technology
K Specialist   Contract Specialist
KBS   Knowledge-Based System
KO   Contracting Officer
KOPeR   Knowledge-Based Organizational Process Redesign
KTR   Contractor
LOA   Line of Accounting
MCRD   Marine Corps Recruit Depot
NECO   Navy Electronic Commerce On-line
PALT   Procurement Action Lead Time
RCO   Regional Contracting Office
RFP   Request for Proposal
SABRS   Standard Accounting, Budgeting and Reporting System
SAT   Simplified Acquisition Threshold
SPS   Standard Procurement System
SOW   Statement of Work
TQM   Total Quality Management
WP   Word Processor

Appendix B Abbreviations

C   Credit
CC   Credit Check
CR   Credit Request
CM   Case Manager
Descrip.   Description
EDI   Electronic Data Interchange
ES   Expert System

ESOP	Employee Stock Option Plan
FS	Field Sales
IPT	Integrated Product team
IT-C	Information Technology-Communication
IT-S	Information Technology-Support
IT-A	Information Technology-Automation
LAN	Local Area Network
N	No
OOM	Order of Magnitude
Organ.	Organization
P	Pricing
Q	Quote
T	Terms
WF	Work Flow
WFM	Work Flow Management
Y	Yes

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I.   INTRODUCTION

A.   BACKGROUND

Success in any endeavor over time requires organizations to adapt to changing environments. In order to maintain continued success, organizations must be willing and able to adapt to the new environment.

Throughout history, the environment that organizations operate in has usually changed slowly and could be adapted to by small incremental changes within the organizations. However, there are times that the environment in which organizations operate changes rapidly, such as the industrial revolution and the one currently encountered by organizations, the computer age. During these times, organizations must change more rapidly in order to maintain their success. In today's world of high technology and the global economy, organizations that only implement small incremental changes over a period of time may find themselves behind their competitors and may ultimately be pushed out of the business.

> Objectives of 5% or 10 % improvement in all business processes each year must give way to efforts to achieve 50%, 100% or even higher improvement levels in a few key processes. Today firms must seek not fractional, but multiplicative levels of improvement-10X rather than 10%. Such radical levels of change require powerful new tools that will facilitate the fundamental redesign of work. [Ref 2: p1]

One of the tools able to make order of magnitude changes is process innovation. Process innovation combines a process view of the business with the application of innovation to key processes. In order to gain the order of magnitude change that is required for process innovation, these key processes must be redesigned from beginning to end using all the innovative techniques and resources available to the organization.

In trying to innovate a process, many individuals become overwhelmed with the work required to come up with a new process that may provide more efficiency. They are faced with a status quo process that works and is understood by all personnel involved with the process. Usually the only change that is desired is incremental and slow in its implementation. This method of change provides stability for the personnel

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involved in the process. However, this method rarely provides the increased efficiency that many organizations require to stay competitive in today's high technology world.

> Our experience suggests that companies can institutionalize incremental improvement through organizational and cultural change programs, with those doing the work identifying and implementing small changes in product and process. But we see no realistic way to conduct process innovation during the course of business. Companies typically treat innovation activities as special tasks, assigned to project teams or task forces. We believe that the project or special initiative structure is the only way to accomplish radical innovation. [Ref 2: p23]

Another method to achieving process innovation is through the use of personnel outside the organization who do not possess any pre-conceived notions about how the process should work.

Process Innovation relies on radical change of current processes in order to take advantage of the new technologies that are available to the world today. This research looks at a knowledge based decision support system that assists in making the radical changes that are necessary for process innovation.

Knowledge-Based Organizational Process Redesign (KOPeR) is a proof-of-concept knowledge based system (KBS) designed to perform measurement-driven inference. [Ref: pA2] The KOPeR design integrates one taxonomy of process pathologies with another taxonomy of redesign transformations. Both taxonomies are organized into classes and subclasses of problems/transformations to support classification and matching. Inference in KOPeR is predicated on production rules. Such rules are used in conjunction with knowledge taxonomies and diagnostic measures. Specifically, rules are used to interpret empirical measurements, diagnose process pathologies and match such diagnoses with appropriate redesign transformations. KOPeR-Lite is a condensed version of KOPeR that is utilized in redesign experiments that will be analyzed by this research to determine its effectiveness.

In this thesis, the KOPeR-Lite decision support system is used to redesign the contracting process at the Marine Corps Eastern Recruiting Region Regional Contracting Office. The Davenport process innovation framework is used to analyze the contracting process to determine if the process lends itself to innovation.

B.   PURPOSE

The primary goal of this research is to assess the effectiveness of process innovation techniques using a knowledge-based decision support system and to employ these techniques to redesign the contracting process in the Marine Corps Eastern Recruiting Region Regional Contracting Office.

C.   AREA OF RESEARCH AND RESEARCH QUESTIONS

1.   Area of Research

The goal of this research is two-fold. First it is to assess the effectiveness of a decision support system. Secondly the decision support system is used to assist in redesigning a specific contracting process in the Marine Corps.

2.   Research Questions

a.   Primary Research Question

How effective is the KOPeR-Lite decision support system in accomplishing process innovation through the redesign of critical contracting processes?

b.   Secondary Research Questions

- What is Process Innovation, and what decision support systems are available to assist in the redesign of critical processes?

- What is KOPeR-Lite, and how does it function?

- What historical evidence exists concerning the effectiveness of KOPeR-Lite in redesigning processes?

- What is the current process for acquiring goods and services at the Marine Corps Eastern Region Recruiting Regional Contracting Office, and is there potential for process innovation?

- How can KOPeR-Lite be applied to the contracting process at the Marine Corps Eastern Recruiting Region Regional contracting office?

- How can the results of this study be utilized by other contracting offices within the Marine Corps?

D.   SCOPE

The scope of this thesis includes a review of materials on process innovation, knowledge based decision support systems, and process reengineering. An analysis of experimental data are performed to assess the effectiveness of KOPeR-Lite.   The

knowledge gained from the analysis is applied to the contracting process at the Marine Corps Eastern Recruiting Region Regional Contracting Office.

E. METHODOLOGY

The methodology used in this thesis research consists of reviewing data from existing material (e.g. books, professional journals, the world wide web), data generated by subjects in the process redesign experiment, information from the Marine Corps Eastern Recruiting Region Regional Contracting Office, which includes Marine Corps Directives on the procurement process, regulations and guidelines for the purchase of goods and services within the organization and information gathered through personal interviews conducted with personnel involved in the contracting process in the organization.

Process analysis is conducted using the Davenport framework and a redesign of the contracting process for acquiring goods and services at the Marine Corps Eastern Recruiting Region Regional Contracting Office.

Analysis of experimental data are accomplished through the method of content analysis, and the data are analyzed by at least two researchers. Process innovation/reengineering is accomplished through the use of a combination of the Davenport framework and KOPeR-Lite.

The data and knowledge obtained from the analyses is used to make recommendations about the usefulness of KOPeR-Lite in facilitating process innovation and assists in redesigning the contracting process at the Marine Corps Eastern Recruiting Region Regional Contracting Office.

F. BENEFITS OF RESEARCH

This research helps determine the usefulness of the knowledge-based decision support system, KOPeR-Lite. This research also proposes recommendations for the redesign of the contracting process at the Marine Corps Eastern Recruiting Region that will enable the process to become more efficient in its service to its customers. Since this research is conducted with input from the personnel currently in the process, the findings and recommendations will more likely be accepted and implemented at the command.

G.   ORGANIZATION OF STUDY

Chapter II follows this introduction and reviews the historical basis of process innovation and summarizes Davenport's approach to process innovation. It also discusses the knowledge-based decision support system, KOPeR-Lite, and how it assists in process innovation.

In Chapter III, the redesign decision support system experiment is examined and analyzed to reveal the effectiveness of KOPeR-Lite in process innovation.

Chapter IV looks at the current contracting process at the Marine Corps Eastern Recruiting Region Regional Contracting Office and applies Davenport's process innovation framework along with KOPeR-Lite to redesign the process. The results of this application are analyzed and two contracting process redesigns are developed for the contracting office.

Chapter V summarizes key conclusions; answers research questions, and presents recommendations for further research.

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II.   PROCESS INNOVATION

A.   GENERAL

The pace of technological change has created an environment in which organizations must be able to adapt and change much faster than they previously thought possible. The predominant method of change used since the early 1980s has been continuous improvement exemplified through approaches such as Total Quality Management (TQM). The method of continuous improvement has helped many organizations make small, incremental changes to maintain their competitiveness in their business environment. However, this method is slow and cannot produce the radical changes necessary to keep pace with the speed of technological change in the environment. In order to keep pace, organizations must re-evaluate what they are doing, how they are doing it, and most importantly why they are doing it. Organizations must be willing and able to move away from traditional methods of operating that have been made obsolete by the changing technology.

1.   Process Innovation

Process innovation combines a structure for doing work with an orientation to visible and dramatic results. It involves stepping back from a process to inquire into its overall business objective, and then effecting creative and radical change to realize order-of-magnitude improvements in the way that objective is accomplished. [Ref 2: p10]

Process innovation is the method by which organizations can make the radical changes necessary to gain the order of magnitude improvement they require to stay competitive. In order to accomplish this organizations must take a process view of their operations that encompasses all parts of their organization from beginning to the end. They must be willing to relinquish traditional ideas about their business operations and be able to adapt to new methods and processes that will allow them to keep pace with their environment.

a.   Process

A Process is defined as "…a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer." [Ref 5: p35]

Davenport describes a process as "…a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to the product focus's emphasis on what." [Ref 2: p5] These definitions outline concepts that are central to this research into process innovation. The concepts of inputs, outputs, customers, measures, order of work, time and structure provide a framework that enables us to examine any process by mapping the activities that take place in an organization from beginning to the end. Once the design of the current process is identified it can be measured for efficiency and effectiveness and more importantly it can be redesigned to enhance its efficiency and effectiveness.

b.   *Innovation*

Innovation is simply creating something new. Some of the ways organizations stay competitive are creating/designing new products or changing current products to meet the changing customer demand. Organizations that take a process view of their operations stay competitive by innovating processes that produce the current good or service in a more efficient way. This method brings about change that can keep pace with the technological advances in today's environment.

2.   Process Innovation versus Process Improvement

Process innovation provides results that process improvement cannot; radical change and order of magnitude improvement in efficiency. Process improvement is often the preferred method of organizations because it keeps the operation essentially the same with only small, incremental changes. Personnel involved in the operation feel more secure if they are able to do things in a traditional manner or if they only change small parts of which they have control over. Process improvement is limited in scope and is often not coordinated throughout the organization. The improvements generally come from the bottom up and effect only a small area of the organization. These factors that limit the improvement to individual areas do not lead to overall improvement in the organization.

In order to obtain all the benefits from process innovation the entire business process must be examined from beginning to end and the organization must be committed to implementing the changes found during the process.

3. Process Innovation Examples

a. *IBM Credit Corporation*

In the 1980s IBM Credit Corporation innovated its financing process and lowered its turnaround time from seven days to four hours. The old process required five different tasks that were performed separately by five different departments within the company.

Step one was receipt of the finance request from the sales representative by a group of operators that logged in the request then sent it to the credit department. Step two, a specialist in the credit department would enter the information into a computer system and check the potential borrowers creditworthiness. The specialist would record the information on a piece of paper and send it to the business practices department. Step three, a person in the business practices department would modify the standard loan covenant in response to the customer request. This department had its own separate computer system to perform this function. Once completed, the special terms would be attached to the request form and sent to the pricer. Step four, the pricer would enter the data into a personal computer spreadsheet to determine the appropriate interest rate to charge the customer. The pricer would then write the interest rate on a sheet of paper and forward the request to the clerical group. Step five, an administrator would receive all the information and prepare a quotation letter that would be delivered to the sales representative by express mail.

The lengthy time it took to approve the request gave the customer time to rethink their options about where to receive their financing or to find another place to buy their computer products. IBM researched the process and discovered that the actual work time required to perform all the separate functions only took ninety minutes. Therefore, they concluded that the problem did not lie in the tasks and the people performing them, but in the structure of the process itself.

IBM was able to solve the problems by redesigning the entire process. Instead of sending the request to the specialists in the different departments they replaced the specialists with generalists located in one department. Now, one person called a deal structurer processes the entire application from beginning to end. This eliminated the

time delay that occurred from handing off the request from department to department. The redesign enabled the order of magnitude reduction in process time without adding personnel to the process. IBM was also able to increase the number of deals a hundred times over their previous production. [Ref 5: pp36-38]

b. Ford Motor Company

Another example can be seen at Ford Motor Company where in the 1980s they were able to cut their accounts payable staff from 500 personnel to 125 personnel. The old process required the purchasing department to send a purchase order to a supplier, with a copy going to the accounts payable department. When the goods were received at the receiving dock at Ford the clerk would complete a receiving form and send it to the accounts payable department, while the suppliers sent a payment invoice to Ford for payment of the goods. All three documents had to match or be reconciled before payment was made to the supplier.

Upon research into the situation, Ford discovered that a majority of the work time in the accounts payable department was spent on reconciling the purchase orders that did not match with the other documents. Ford was able to reduce the number of personnel by breaking away from their old rule of paying when they received the invoice from their suppliers to paying when they receive the goods. They no longer required three separate forms of documentation on the same purchase order; instead, the purchase order was input into an on-line database, suppliers sent the goods to Ford, and a clerk at the receiving dock checked a computer terminal to see if the goods received matched the purchase order. If they matched, the clerk pushed a key on the terminal to accept the goods, which told the database that the goods had arrived. The computer would then automatically issue and send a check to the supplier. If the goods did not match the purchase order they would be sent back to the supplier. [Ref 5: pp39-41]

The innovations and order of magnitude improvements achieved by these companies would not have been possible without the assistance of information technology. The breakthroughs in the way information is received and shared through the use of technology enabled the innovative changes at these companies to succeed.

c. *Alpha Contracting*

Contracting for major systems in the Department of Defense has traditionally been conducted in a sole-source contracting process in which the Government worked separately from the civilian contractors in a sequential process. First the Government would define its requirement and prepare a statement of work (SOW), draft a request for proposal (RFP), approve the RFP, and then release a synopsis of the proposal to the public. Contractors would then request a copy of the RFP, evaluate the RFP and the SOW and submit questions back to the Government. The Government would answer the questions and send the reply to the contractor. The contractors would develop a proposal and mail it back to the Government. The Government would evaluate the proposals. Fact-finding would then be conducted jointly after which the two sides would separate again and the Government would prepare their business clearance memorandum and the contractor would prepare their negotiation targets. Negotiations were conducted jointly and then the Government awarded the contract. [Ref 14]

Alpha contracting is a method of contracting for major systems in a sole source environment that greatly reduces the handoffs and confusion created in the traditional contracting process by teaming the government and contractor from the beginning of the process to the end. In alpha contracting the SOW and the draft RFP are prepared jointly by the Government and the contractor, the documents are then approved separately and the Government publicizes the proposal. The two sides then join together and develop the contract proposal, negotiations are conducted and the contract is awarded.

Alpha contracting greatly reduces the number of document revisions necessary when the process was conducted under the old closed-door policy in which everything was performed separately. It also ensures that the Government requirement is met by the contractor proposal because it is developed jointly.

B. DAVENPORT PROCESS INNOVATION FRAMEWORK

Innovation can come in many different forms using a variety of methods, however, a framework upon which innovations can be understood and implemented is an invaluable tool to today's business. In 1993, Thomas Davenport published his book

outlining a framework for process innovation that consists of five phases that are listed in Figure 2 and discussed further in this chapter.

Davenport's Process Innovation Framework Phases
•   Phase 1   Identify Process for Innovation •   Phase 2   Identify Change Levers •   Phase 3   Develop Process Vision •   Phase 4   Understand Existing Processes •   Phase 5   Design and Prototype the New Process

Figure 2.	Davenport's Process Innovation Framework. From Ref 2.

### 1.	Identifying Processes for Innovation

Phase one of the Davenport framework consists of key activities to determine which processes are candidates for process innovation. The selection of the process establishes the boundaries of the processes that are to be addressed by the organization. The principle activities in the selection process are listed in Figure 2.1.

Key Activities in identifying Processes for innovation
•   Enumerate major processes •   Determine process boundaries •   Assess strategic relevance of each process •   Render high-level judgments of the "health" of each process •   Qualify the culture and politics of each process

Figure 2.1.	Key Activities in Identifying Processes for Innovation. From Ref. 2.

#### a.	*Enumerate Major Processes*

The number of processes in an organization can vary from one to a hundred depending upon how the organization defines each process. The ability to achieve innovative results depends upon selecting processes that are critical to the organization and keeping the number of processes within a range that can be handled by the organization, generally between 10-20 processes. If too many processes are selected

for innovation, the organization may not have the resources to effectively innovate the processes. The organization may not be ready or able to control the amount of change that comes from innovating a large number of processes at the same time.

b. *Determine Process Boundaries*

The boundaries of each process selected must be established in order to effectively manage the innovation that is to occur in the organization. A definite beginning and end must be established along with an idea of where each participant's concern begins and ends. Each process that is to be innovated is part of a much larger process either internal or external to the organization and therefore the organization must understand that innovating of one process may result in the need to innovate or improve connecting processes.

c. *Assess Strategic Relevance of each Process*

When selecting processes for innovation, an organization should select a process that is critical to their overall business strategy. In Government contracting, the strategy of most contracting offices is improvement of customer service. The result of budget constraints and defense downsizing means that contracting offices must accomplish more with less. They must deliver the good or service that the customer requires in a more timely and effective manner than in the past. The process that is most likely to provide innovation is the process of procurement request fulfillment.

d. *Determine the Health of each Process*

Many organizations select a process for innovation by determining which process needs the most improvement. "Some symptoms of unhealthy processes include the existence of multiple buffers, reflected in work-in-process queuing up at each step." [Ref 2: p32] Innovating the processes with the poorest health can yield dramatic improvements for the organization.

e. *Qualify the Culture and Politics of each Process*

"The Primary goal of process qualification is to gauge the cultural and political climate of a target process." [Ref 2: p32] Each process that is selected for innovation must have the commitment of senior management and be the direct responsibility for someone in the organization. The process must also exhibit the need for improvement. If there is no identifiable need for change and the organization is not committed to the change then the process innovation should not be attempted.

2.   Identify Change Levers

Phase two of the Davenport framework covers the identification of change levers or enablers that are available to organizations. Technological and human resources need to be analyzed for the ability to help innovate the process. A list of the key activities used to identify possible enablers can be seen in Figure 2.2.

Key Activities for Identifying change enablers
• Identify potential technological and human opportunities for process change
• Identify potentially constraining technological and human factors
• Research opportunities in terms of application to specific processes
• Determine which constraints will be accepted

Figure 2.2   Key Activities in Identifying Change Enablers. From Ref 2.

During this phase the organization must consider both what is possible and the constraints imposed by the current technology and human resources available to the organization. All the enablers need to be researched to determine their potential for innovating processes within the specific organization. The method by which the technology or human resources is to be used in the process must be determined before it is applied to the specific process. Once the opportunities and constraints have been determined the organization must determine which constraints they are going to accept and work within and which constraints they are going to overcome by some method.

a.   *Information Technology in Process Innovation*

"By virtue of its power and popularity, no single business resource is better positioned than information technology to bring about radical improvement in business processes." [Ref 2: p17] Davenport outlines nine categories in which information technology provides opportunities to support process innovation. (See Figure 2.2.1)

Impact of Information Technology on Process Innovation	
Impact	*Explanation*
Automational	Eliminating human labor from a process
Informational	Capturing process information for purposes of understanding
Sequential	Changing process sequence, or enabling parallelism
Tracking	Closely monitoring process status and objects
Analytical	Improving analysis of information and decision making
Geographical	Coordinating processes across distances
Integrative	Coordination between tasks and processes
Intellectual	Capturing and distributing intellectual assets
Disintermediating	Eliminating intermediaries from a process

Source: Davenport's Process Innovation

Figure 2.2.1   Impact of IT on Process Innovation

In order to gain advantages available from IT the organization should identify which of the above categories are relevant to their organization and to the specific process that they are trying to innovate. Research should be conducted to find examples of similar use of these categories in other firms that may help establish which category is right for the organization's strategy.

"…the capabilities of IT should be phrased in terms of application to common, or generic, business problems." [Ref 2: p55] The application of the technology should be used to solve the business problems and should not be used as a way to find

uses for the new technology. Generic applications can be used in product development, order fulfillment, and logistical processes such as automated design, simulation systems, microanalysis and forecasting, voice communications effectiveness, locational systems and logistical planning systems. The generic applications give the organizations a way to understand how the information technology can be used to enable process innovation.

b. Information Technology as a Process Constraint

Even though information technology is one of the best enablers of process innovation, it does pose some problems that must be addressed when applying it to a process. The major constraint associated with information technology is that of legacy systems embedded the current processes. Organizations that try to start with a clean slate in designing a new innovative process are usually derailed by the cost and wide spread use of legacy information technology systems. Organizations that do not currently use information technology in their processes also encounter the constraint of legacy systems used by either their suppliers or customers in processes that are interfaced with the new process under development by the organization. Another constraint when using information technology for process innovation is the non-availability of a package of information technology that will match perfectly with the new process design. Organizations are limited by the technology available or are faced with an expensive alternative of designing the technology to fit their new process design.

c. Organizational and Human Resource Enablers of Process Change

"…information and IT are rarely sufficient to bring about process change; most process innovations are enabled by a combination of IT, information, and organizational/human resource changes." [Ref 2: p95]

Organizational enablers are concerned with the structure and culture of the organization. The main structural change that can be made to enhance process innovation is the formation of teams within the organization. For years it was thought that an individual could become more productive by working alone on a task and becoming more proficient at the task. Using a process view of an organization, teams can become more efficient than the individuals. Teams are able to combine multiple tasks

into one. Teams are able to group a lot of different specialties into one group. The group or team can then perform functions that were too complex for an individual. Another benefit of changing to teams is the social aspect of human beings. Most people prefer jobs that include social interaction. Teams are able to build friendships between its members that enhance the workers overall productivity.

Cultural enablers of process innovation include empowerment and participation in the decision process. This has lead to more horizontal organizational hierarchies, higher productivity and greater employee satisfaction. These cultural changes have assisted process innovation by allowing the personnel involved in the processes to assist in the new designs. In order to effectively implement the innovative process redesign, the personnel charged with its implementation must feel that they are part of the new process.

Human resource enablers of process innovation covers areas such as training, compensation, career paths, work role rotation, and lifetime employment. Although human resource changes by themselves will normally not bring about order of magnitude improvement within an organization, their absence will place severe constraints on process innovation.

The organizational and human resource enablers described above must be used in conjunction with the information technology enablers if the process innovation is to be successful.

3.   Developing Process Visions

Phase three of the Davenport framework involves the establishment of a process vision. The key activities in developing process vision can be seen in Figure 2.3.

Key Activities in Developing Process Vision
- Assess existing business strategy for process directions   - Consult with process customers for performance objectives   - Benchmark for process performance targets and examples of innovation   - Formulate process performance objectives   - Develop specific process attributes

Figure 2.3   Key Activities in Developing Process Visions. From Ref 2.

"Process innovation is meaningful only if it improves a business in ways that are consistent with its strategy." [Ref 2: p117] In order for an organization to fully achieve process innovation that enables them to succeed in the future, the innovation must be in concert with their overall business strategy.   An organization's strategy must encompass a vision that sets the direction for process innovation. As with most endeavors, if the organization wants to succeed, they must consult all personnel involved in the process; customers, suppliers and other stakeholders. The customers need to be consulted in order to gain a perspective of the performance objectives that the organization should strive to achieve in the process. Suppliers need to be consulted when innovating the organizations processes to ensure that they understand what the organization is trying to do and also to provide added insight into possible innovative ideas.   Organizations should also benchmark their performance in the process against similar processes in other organizations. This will provide additional insight into possible redesign alternatives and help to better define the organizations performance objectives. The organization should also define the process attributes, which are the descriptive, non-quantitative adjuncts to the process objectives.   The attributes are considered the principles of the process operation. They describe what the process will look like and how it will function in a future state. Establishing a process vision is essential to providing direction for the innovative results the organizations desires to achieve.

3.   Understanding and Improving Existing Processes

Phase four of the Davenport framework involves designing and prototyping the new process. Before embarking upon the design of a new process the existing process must be understood. There are four reasons why an organization should understand the existing process before proceeding with innovation. First, it facilitates communication and develops a common understanding of the current process. Second, it provides an understanding of the tasks required to move from the old to the new process. Third, it illuminates the existing problems with the current system and ensures that they are not repeated in the new process. The fourth reason is that it provides a measure of the value of the proposed innovation.

The key activities in understanding and improving existing process are listed below in Figure 2.4.

Key Activities in Understanding and Improving Existing Processes
• Describe the current process flow
• Measure the process in terms of the new process objectives
• Assess the process in terms of the new process attributes
• Identify problems with or shortcomings of the process
• Identify short-term improvements in the process
• Assess current information technology and organization

Figure 2.4   Key Activities in Understanding and Improving Existing Processes. From Ref 2.

When conducting research of the existing process, organizations must always measure and analyze it using the performance objectives and process attributes developed in step three of the Davenport framework. Organizations must determine what information technologies exist in the current system and start to understand how they will be used when innovating the new process. At the end of this step, the organization

should have a clear understanding of what they are faced with and where they want to go with the new process.

4. Designing and Prototyping the New Process

In the fifth and final phase of the Davenport framework, the most important element needed for success is the choice of the personnel to be involved in the design process. A mix of personnel, some with abilities to be creative and innovative and some with the ability to implement the new innovations should be used in comprising the design team. Stakeholders in the new process should be part of the design team to ensure that their interests are considered in the new design. Key activities involved during this phase are listed in Figure 2.5.

Key Activities in Designing and Prototyping a New Process

- Brainstorm design alternatives

- Assess feasibility, risk, and benefit of design alternatives and select the preferred process design

- Prototype the new process design

- Develop a migration strategy

- Implement new organizational structures and systems

Figure 2.5   Key Activities in Designing and Prototyping a New Process. From Ref 2.

The information gathered from the first four phases is analyzed by the design group to generate innovative ideas and concepts for use in the new process design. Brainstorming is a proven method used to come up with and develop new ideas and concepts for the design. Once a number of designs have been developed the feasibility, risk and benefits of each design should be analyzed to provide a basis for selecting the best design. Once a design has been selected a prototype is used to simulate and test the new process. "The goal of prototyping is to gradually shape the organizational environment or, alternatively, to revise the technology. Prototyping must be viewed as a learning activity by the process designers and users alike." [Ref 2: p156] The process of

prototyping may take several attempts to achieve the optimal process desired by the organization. During this phase, the organization must also develop a migration strategy that will enable them to effectively transition from the existing process to the new process. The organization may not be able to immediately shift from the existing process to the new process throughout the entire organization. In the majority of organizations it is necessary to start a pilot process on a small scale in one unit of the organization. The pilot will provide insight into how the migration will affect the organization when the process is implemented throughout the entire organization. The final step in this phase is implementing a new process-based organizational structure that is built around how the work is done rather than around specific skills.

The Davenport provides an excellent framework to assist organization in their innovative efforts. The information provided by this framework provides the basis upon which this research will redesign the contracting process at the Marine Corps Eastern Recruiting Region Contracting Office.

C.   KOPER-LITE

1.   General

During the last decade, business process reengineering (BPR) has become an important aspect in redesigning how organizations operate. The goal BPR is to transform current organizations in order to keep up with or stay ahead of competitors by utilizing the latest technology. In a lot of the cases discussed in the literature the focus has been in the area of workflow automation. "Today, a second generation of computer-based reengineering tools employ knowledge systems technology to automate and support key, intellectual activities required for effective process-workflow redesign." [Ref 10: p1] Process workflow comprises the ordering, sequencing, organization, and technology associated with the work through an enterprise. To effectively accomplish process-workflow innovation it is necessary to understand Davenports framework and utilize the tools available such as KOPeR-Lite.

  KOPeR-Lite is one of the knowledge-based, process-workflow redesign systems and was used in the process workflow redesign experiment that will be analyzed in the next chapter and utilized in redesigning the contracting process at the Marine Corps

Eastern Recruiting Region Contracting Office. KOPeR-Lite provides automated redesign support through measurement driven inference. Measurement-driven inference describes the use of metrics for automated reasoning. In order to understand how the process works, it is necessary to look at the General Redesign Process model outlined by Nissen shown in Figure 2.6. [Ref 11]
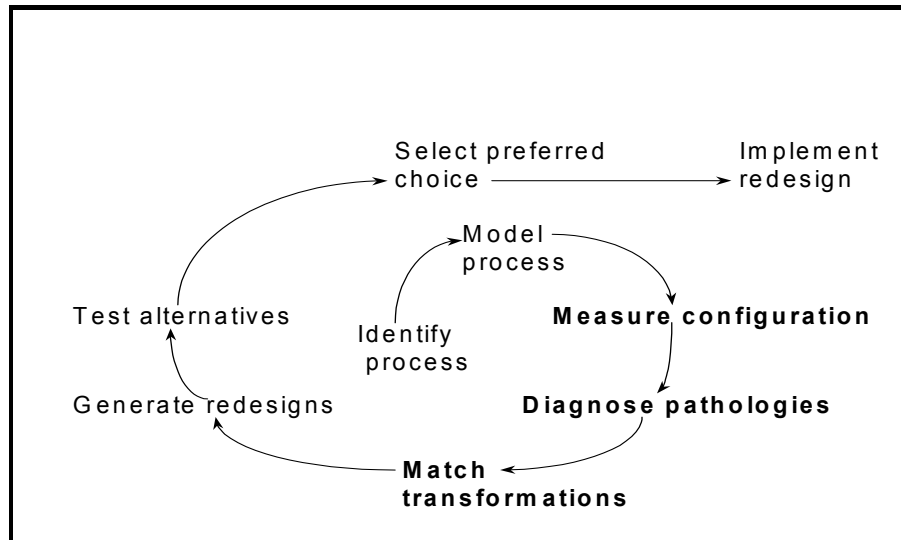
Figure 2.6   General Redesign Process Model. From Ref. 11.

The activities delineated in Figure 2.6 were derived by Nissen and represents a blend of expert reengineering methodologies from reengineering experts. [Ref 11: p3] KOPeR-Lite is designed to facilitate the innovation process by identifying inherent pathologies in processes and providing assistance with the diagnosis then matching redesign transformations.

2.   KOPeR-Lite Mechanics

In order to understand how KOPeR-Lite facilitates process innovation, it is necessary to understand how KOPeR-Lite develops its inferences. KOPeR-Lite measures processes utilizing a set of measures that have graph-based definitions. (See Figure 2.7)

KOPeR-Lite Process Measures	
Measure	*Graph-Based Definition*
Process Length	Nodes in Longest Path
Process Breath	Distinct Paths
Process Depth	Process levels
Process Size	Nodes in Process Model
Process Feedback	Cycles in Graph
Parallelism	Process Size divided by Length
IT Support	IT-Support attributes
IT Communication	IT-Communication attributes
IT Automation	IT-Automation attributes
Organizational Roles	Unique Agent Role attributes
Process Handoffs	Inter-Role Edges
Organizations	Unique Organization attributes
Value Chains	Unique Value Chain attributes

Figure 2.7   KOPeR-Lite Process Measures. From Ref 11.

The terms utilized by KOPeR-Lite represent graphical elements such as nodes, edges, attributes and paths. These terms conform to most modeling tools used for process modeling today. [Ref 10: p3]   KOPeR-Lite works by linking the measures to corresponding pathologies that can be diagnosed, then matching them to redesign transformations.   The pathologies classify problems existent in the processes being diagnosed by detecting and classifying a variety of common process pathologies. Figure 2.8 outlines how some of the KOPeR-Lite diagnostic measures are derived and their corresponding Pathologies.

KOPeR-Lite Diagnostic Measures and Pathologies		
Measures	*Formula*	*Pathology*
Parallelism	Process Size / Length	Identifies the degree to which a process flow is sequential.
Handoff Fraction	Process Handoffs / Size	Identifies the level of friction in the process flow caused by handoffs between nodes.
Feedback Fraction	Process Feedback / Size	Identifies the level of rework produced when a checking approach to quality is used.
IT Support Fraction	IT Support / Size	Identifies the level of IT support in the process.
IT Communication Fraction	IT Communication / Size	Identifies the level of IT communication in the process.
IT Automation Fraction	IT Automation / Size	Identifies the level of IT Automation in the process.

Figure 2.8   KOPeR-Lite Diagnostic Measures and Pathologies. From Ref 11.

KOPeR-Lite employs a set of rules gained from BPR knowledge that classify the pathologies on the basis of process measurements and can be seen in Figure 2.9. Utilizing these rules, KOPeR-Lite identifies probable instances that have affected the measure.

Taxonomy of Process Pathologies	
Pathology Class	*Sample Instance*
Problematic Process structure	Sequential process flows
Bureaucratic organization	Job specialization
Fragmented process flows	Process friction
It infrastructure	Manual process
"Checking" approach to quality	Review-intensive process
Centralized authority	Long decision chains
Under-Utilized human potential	Training emphasis
Inhibitive leadership	Directive supervision
Centralized information	Central database architecture
Deficient core competency	Low IT experience

Figure 2.9   KOPeR-Lite Process Pathologies . From Ref 11.

The next step in KOPeR-Lite also utilizes knowledge gained from BPR experience gained over the last decade to populate its taxonomy. In this step the process pathologies are matched to possible redesign transformations.   The possible transformations provide the information needed to assist in the redesign of the process. It gives the process innovators solutions to develop new processes that correct the problems in the current process or in new design alternatives. Figure 2.10 outlines the taxonomy of redesign transformations.

Taxonomy of Redesign Transformations	
Transformation Class	*Sample Instance*
Workflow reconfiguration	Process de-linearization
Information Technology	Shared database system
Organizational design	Case manager
Human resource	Team-based compensation
Information availability	Inform agents
Inter-organizational alliance	Supplier-managed inventory
Management and culture	Employee stock ownership

Figure 2.10.   KOPeR-Lite Redesign Transformations. From Ref 11.

By using KOPeR-Lite, the organizations trying to innovate their workflow processes will be able to evaluate the redesign alternatives available to them. The two key functions of KOPeR-Lite, automating pathology diagnosis and transformation matching, enable innovators to better understand the processes they are working with and determine which redesign alternative will produce the most dramatic results.

D.   SUMMARY

This chapter outlined process innovation and gave a few examples in which process innovation has produced dramatic results. The Davenport process innovation framework was to understand the methodology needed in innovating processes. Lastly, we looked at a knowledge-based decision support system, KOPeR-Lite, and how it assists in redesigning process workflow. In the next chapter an experiment utilizing KOPeR-Lite will be analyzed to determine how effective it is in redesigning processes.

III.   REDESIGN DECISION SUPPORT SYSTEM EXPERIMENT

A.   EXPERIMENTAL DESIGN

1.   Hypothesis

The knowledge-based decision support system experiment analyzed in this chapter is concerned with process workflow redesign using KOPeR-Lite.   The experiment directly compares the performance of BPR novices formulating redesign alternatives using KOPeR-Lite against the performance of BPR novices formulating redesign alternatives without the assistance of KOPeR-Lite.   The hypothesis to be tested through this experiment is: The use of KOPeR-Lite enables BPR novices to produce (1) a greater number of redesign alternatives and (2) redesigns that are higher in quality with regard to feasibility and overall impact.

The hypothesis tested in this chapter is drawn from Holly Korzilius' work, which examines a similar experiment. [Ref 7] For consistency across experiments, the analysis conducted in this chapter utilizes the same methods employed by Korzilius; however, this present study examines the performance of a different group of subjects tasked with redesigning a separate process. Integrating these two experiments represents a topic for future research.

2.   Laboratory Design

 The experiment studies two groups of subjects drawn from students in the acquisition curriculum attending the Naval Postgraduate School.   The subjects are screened prior to their participation in the experiment to ensure that they do not possess prior BPR experience, thereby enabling them to be classified as "novices" in the field of reengineering and process workflow redesign. All subjects in the study are given one hour of instruction on re-engineering and redesign prior to being assigned the task of developing redesigns for the credit financing case contained in Appendix A. All the subjects are given several days to understand the re-engineering concepts and ask questions of the course instructor to clarify any areas that they did not fully understand during the instruction.

The experiment is then conducted during a single, two hour long laboratory period. During this time, the subjects individually develop as many redesign alternatives as possible for the credit financing case. The first group of subjects completes the task without the use of KOPeR-Lite while the second group of subjects completes the task utilizing KOPeR-Lite.

3. Criteria for Analyzing Redesign Alternatives

The redesigns are analyzed utilizing the criteria developed by Korzilius. The criteria are outlined in Figure 3 and discussed further in this chapter.

Criteria for Analyzing Redesign Alternatives

- Number of redesigns generated
- De-linearization of process flows
- Enablers
    - Information technology
    - Organizational Design (other than IT)
- Reduction in the number of non-value-added activities
- Change in the number of feedback loops
- Change in the number of handoffs
- Clarity of the redesign descriptions
- Impact of the redesign

Figure 3.   Criteria for Analyzing Redesign Alternatives. From Ref 6.

a. *Number of Redesigns Generated*

Redesigns need to be distinct in that a reader should be easily able to determine where one redesign description ends and another begins. In some cases, redesigns are presented simultaneously in a fashion such that one is unable to discern which features belong to which redesign. In such cases, the analyst is forced to use his or her best judgment to determine the number of redesigns generated by the experimental subject.

b. *Delinearization*

Delinearization means that two or more activities that were carried out sequentially in the baseline process are carried out simultaneously in the redesign. Activities could be grouped together in the redesign without necessarily resulting in delinearization. For example, the terms and pricing activities could be merged into a single cell where the pricers must still wait for the term specialist's output before they can commence work. Therefore, the flow is still sequential. However, if this combined cell utilizes personnel or technology that can simultaneously produce both the terms and price, delinearization has been incorporated into the redesign. A binary (e.g. yes/no, 1/0) determination is made for this criterion.

c. *Enablers*

An enabler is anything that results in increased process efficiency or effectiveness. Enablers include, but are not limited to: information technology such as shared databases, computer networks, electronic mail (e-mail), automated forms, video teleconference, organizational design enhancements such as grouping of related activities to facilitate information exchange and work coordination or inclusion of a case manager who would have oversight over a group of activities; and human resource factors such as enhanced training or other personnel support initiatives. Each example of an enabler incorporated into a redesign is counted and the overall number of enablers per redesign tallied. An enabler that is used multiple times within a single redesign is only counted once. For example, e-mail may be used in four activities within the redesign, however the e-mail enabler is counted only once for that redesign. A distinction is made between IT enablers and those not involving technology, as they tend to involve qualitatively different approaches to process innovation and can be particularly powerful when applied in combination.

d. *Reduction in the Number of Non-Value-Added Activities*

The number of activities in a redesign process may increase or decrease from the number included in the baseline. It is expected that by adding or removing an activity, the overall efficiency and effectiveness of the process workflow will be enhanced. For example, the sales activity might be eliminated as superfluous under the

supposition that customers can communicate their financial needs to the credit finance company via telephone or a website as opposed to going through a field sales agent.

e. Change in the Number of Feedback Loops

A feedback loop occurs any time work from one activity is sent back to an earlier activity in the process. For example, if the quotation activity finds a deficiency in the credit request it must be sent back to the sales agent so that the deficiencies can be addressed. Sometimes, as in the case of micromanagement, excessive feedback loops inhibit efficiency and should be eliminated.

f. Change in the Number of Handoffs

The number of handoffs occurring in the process workflow is dependent on the overall number of activities as well as the manner in which they are carried out. An example of how the number of handoffs may be reduced while keeping the overall number of activities the same is depicted in Figure 3-1.
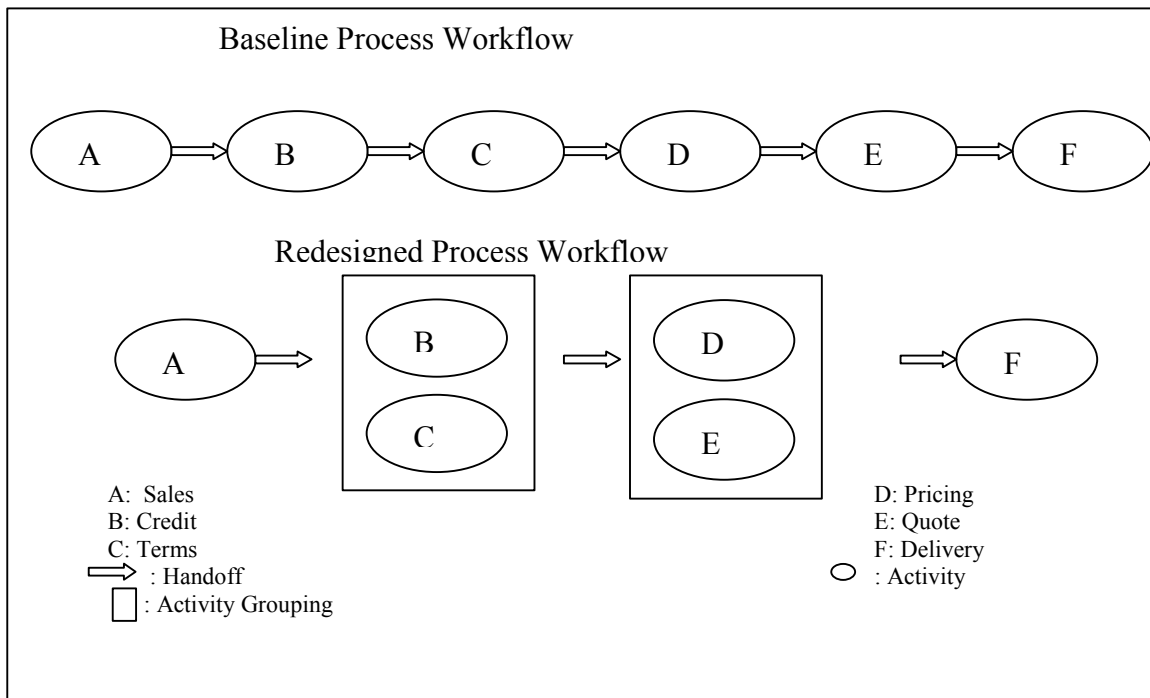
Figure 3.1.   Redesign Example Highlighting a Reduction in the Number of Handoffs. From Ref 6.

In this example, activities B and C as well as D and E are combined into two integrated activities. By doing this, the number of handoffs is reduced from five to three.

g.   *Clarity of the Redesign*

Essentially, this is the ease with which one is able to discern the features of a proposed redesign. A scale from one to three is used. The following criteria are applied to objectify this largely subjective metric:

1 – not very clear; no redesign graphic, redesign metrics are not included; textual description fails to enhance a reader's ability to discern what the author is trying to convey.

2 – clear; a redesign graphic or metrics are provided, textual description provides the reader with a good understanding of the author's redesign. Redesigns where the author provides both a redesign graphic and metrics, but a mediocre textual description is included, are also assigned a value of clarity value of 2.

3 – very clear; both a redesign graphic and redesign metrics are included and the textual description provides the reader with an exceptionally clear mental picture of the author's redesign.

h.   *Impact*

A scale from one to three is used. The following criteria are applied to objectify this basically subjective category:

1 – infeasible or feasible but negligible impact

2 – feasible and moderate gains in efficiency and effectiveness of the process workflow anticipated

3 – feasible and significant gains in efficiency and effectiveness of the process workflow anticipated

4.   Assessment Procedure

The credit financing case contained in Appendix A is presented to two groups of graduate students at the Naval Postgraduate School. The redesigns produced by each experimental subject are then analyzed based on the criteria. Two independent analyses are conducted: one by the author and one by another researcher. Once these separate analyses are completed, both researchers meet to discuss their individual findings and to generate a single, integrated analysis.

B.   EXPERIMENTAL DATA

Each subject in the experiment proposes redesign alternatives differently, however there are areas in most redesigns that are similar. Below are two examples of the redesign alternatives produced by the subjects.

1.   Redesign Examples

a.   *With-KOPeR Redesign Alternative Example*

The first redesign alternative example was produced by a subject using KOPeR-Lite. The subject de-linearized the process by having the credit check and the terms development activities occur simultaneously because their actions are mutually exclusive of one another. E-mail communication was established to transfer the credit request between activities in the process. The delivery step was removed and the package returned to the field sales representative via e-mail. Figure 3.2 illustrates the proposed redesign alternative along with the scores it received across the eight criteria.

Delinear-Ization	IT enabler	Non-IT enabler	Non-value-added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact
Yes	1	0	1	0	0	2	2
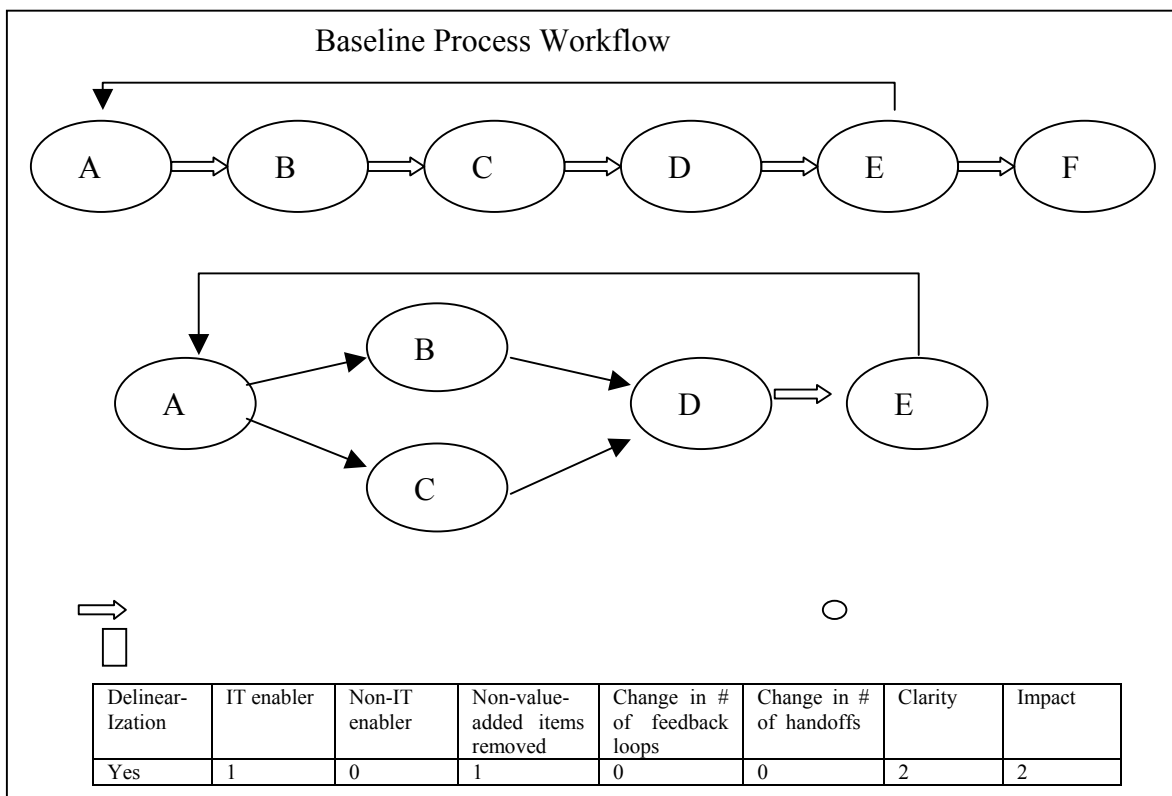
Figure 3.2   With-KOPeR Redesign Alternative Example

In this redesign delinearization occurred with the credit and terms being conducted in parallel. The redesign used one IT enabler, e-mail, and removed one non-value-added item, delivery. The redesign scored a 2 for clarity because it provides a graphic, utilizes metrics and provides a moderate textual description that provides the

reader with a moderate understanding of the author's redesign. This redesign receives a score of 2 on potential impact because it is feasible, but will only produce moderate gains in efficiency and effectiveness of the process workflow. An organizational change such as employee empowerment, job enlargement or a case manager in conjunction with the IT enabler of e-mail would greatly enhance this redesign alternative.

b. Without-KOPeR Redesign Alternative Example

The second redesign alternative example was produced by a subject without the assistance of KOPeR-Lite. The subject in this redesign alternative added a centralized database so that all separate activities could access the data generated by the field representative at the same time. The pricing activity is fully automated utilizing a computer program that is initiated by the credit department. The delivery activity is removed because the field representative has access to the central database and can download the final quote when it is complete. The feedback loop is removed beck feedback is instantaneous within the database. Figure 3.3 illustrates the without-KOPeR redesign alternative.

Delinear-Ization	IT enabler	Non-IT enabler	Non-value-added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact
No	2	0	1	-1	-2	3	2
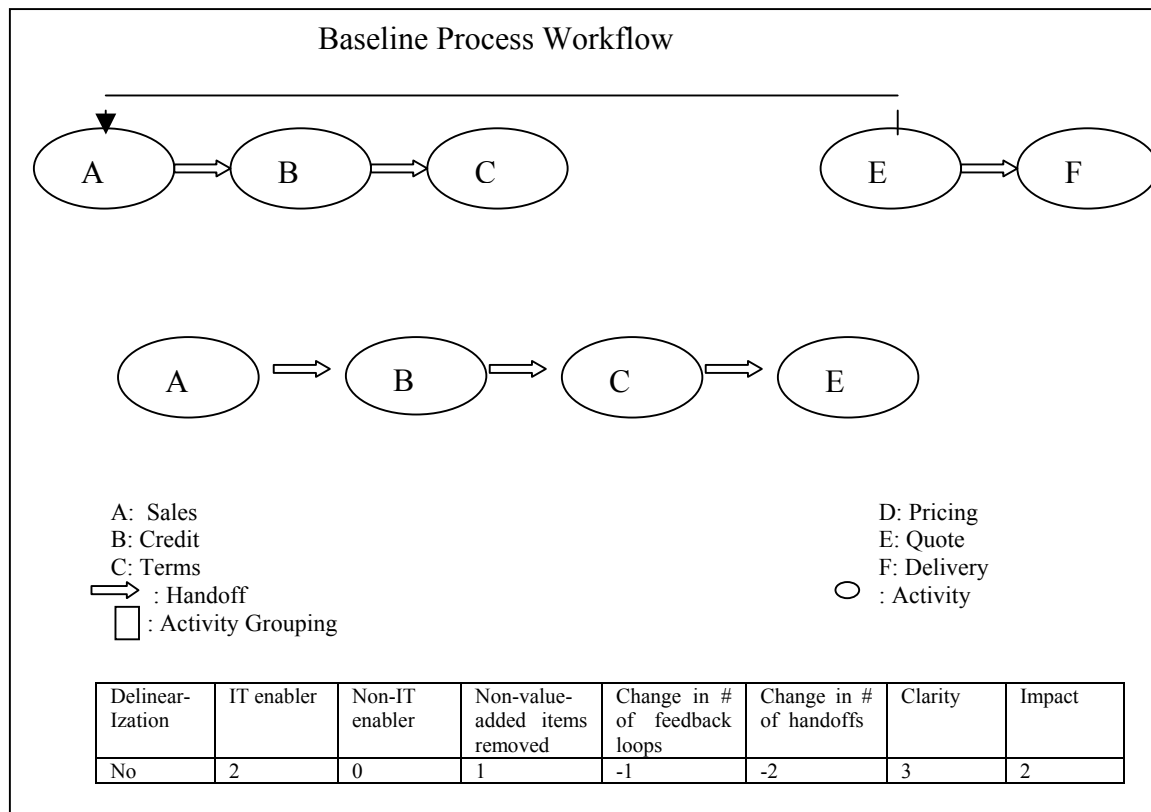
Figure 3.3   Without-KOPeR Redesign Alternative Example

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In this redesign alternative the subject has not achieved delinearization because all the activities in the process are performed in a sequential manner. The subject did use two IT enablers, a central database and automation, along with removing the feedback loop and delivery step. The number of handoffs are reduced by two because of the automation of the pricing activity and the removal of the delivery activity. This redesign receives a clarity score of three because of its use of graphics, metrics and a textual description that provides the reader with an exceptionally clear mental picture of the proposed redesign. This redesign utilizes more than one IT enabler and reduces friction by removing feedback loops and handoffs, however the subject did not employ any non-IT enablers in the proposed redesign resulting in an impact score of two.

c. Experimental Data

The data covering this experiment are listed in Appendix B.

C. EXPERIMENTAL ANALYSIS AND RESULTS

The data generated from the experimental analysis are entered into a spreadsheet in order to perform statistical analysis. First, a correlation analysis is conducted to determine any differences in the two researchers' analyses. Second, an analysis of the integrated data are conducted to assess performance differences between the with- and without-KOPeR-Lite groups.

1. Interjudge Correlation

The first step in analyzing the experimental data are to determine how closely the two independent researchers are with their experimental results. A correlation analysis is conducted on the results of each criteria judged by the researchers. The correlation results are listed in table 3.

Interjudge Correlation							
Delinear-Ization	IT Enablers	Non-IT Enablers	Non-value added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact
0.925	0.697	0.690	0.973	0.873	0.900	0.921	0.940

Table 3.   Interjudge Correlation

As seen in table 3, initial assessments made by the two researchers are highly correlated with over an 85% correlation in six of the eight criteria. The two criteria that fall below 85% correlation, IT enablers and non-IT enablers, are the result of different counting methods and a different understanding of what constitutes a non-IT enabler. The difference in counting is the result of one researcher counting each IT enabler separately each time it is used in the redesign while the other researcher counted the IT enabler used in the redesign only once, no matter how many times that IT enabler is used in the redesign. The integrated analysis counts each IT enabler only once for each redesign no matter how many times they are used in the redesign.

The difference on the non-IT enabler criteria is the result of one researcher counting job enlargement as a non-IT enabler when two activities were merged into one and a single person fulfilling the task that was originally done by two or more people. The other researcher did not count those mergers as job enlargement. The integrated analysis counts the mergers of this type as a non-IT enabler of job enlargement.

The minor differences between the two researchers on the remaining criteria are resolved through a joint analysis of the redesigns in order to come to a one hundred percent agreement on all the criteria results for the integrated analysis.

2.   Integrated Analysis

Once an integrated analysis is developed by the two researchers, a correlation analysis is conducted on each criterion to see if any pairs of criteria move together. If any correlations approach unity, it would mean that the researchers are essentially measuring the same thing within each of the criteria within the redesign. A matrix showing the correlation of the criteria is shown in table 3.1.

Criteria Correlation Matrix									
	Redesigns per subject	Delinearization (0=N; 1=Y)	IT enablers	Non-IT enablers	non-value added items removed	change in # of feedback loops	change in # of hand-offs	Clarity	Impact
Delinearization	N/A	Xxx	0.0121	-0.1513	0	0.0803	0.4085	0.1424	-0.0666
IT enablers	N/A	Xxx	Xxx	0.1331	0.0173	-0.0392	0.0136	0.1668	0.2922
non-IT enablers	N/A	Xxx	Xxx	xxx	0.0982	-0.1893	-0.3955	-0.0187	0.3737
non-value added	N/A	Xxx	Xxx	xxx	xxx	-0.4988	-0.6441	0.2447	0.2257
feedback loops	N/A	Xxx	Xxx	xxx	xxx	xxx	0.4613	-0.2354	-0.2662
Handoffs	N/A	Xxx	Xxx	xxx	xxx	xxx	xxx	-0.0372	-0.3115
Clarity	N/A	Xxx	Xxx	xxx	xxx	xxx	xxx	xxx	0.2486
Impact	N/A	Xxx	Xxx	xxx	xxx	xxx	xxx	xxx	xxx

Table 3.1.   Correlation matrix.

As can be seen in the matrix above only one of the pairs of criteria analyzed for correlation is above fifty percent. The correlation between the number of non-value items removed and change in the number of handoffs is 64%. Intuitively these criteria should move somewhat together and be negatively correlated, because as items are removed from the process, it is likely that the number of handoffs within the process will be reduced. Although lower than 50%, two other correlations are close and merit some discussion. Specifically, the correlation between the non-value-added items removed and the change in the number of feedback loops at -49.9%, and the correlation between the change in the number of handoffs and the change in the number of feedback loops at 46%. Intuitively this makes sense because as the number of non-value-added items are removed there would be less need for feedback loops and as the number of handoffs are reduced the number of feedback loops necessary would decline. The remaining pairs of criteria show low correlations. This suggests that most criteria used to analyze the redesigns are not redundant and examine separate aspects of the redesigns.

In order to test the hypothesis, the data set is broken down into four subsets. The first subset includes all BPR novices who did not use KOPeR-Lite (Without KOPeR, with Outliers); the second subset includes all BPR novices who did not use KOPeR-Lite minus outliers (Without KOPeR, without outliers); the third subset includes all BPR novices who did use KOPeR-Lite (With KOPeR, with outliers); the fourth subset includes all BPR novices who did use KOPeR-Lite minus outliers (With KOPeR, without outliers). Outliers refer to subjects or redesigns who analyzed the baseline process in a

significantly different manner than the majority of the subjects. The typical baseline analysis broke the process down into six activities with five handoffs and one feedback loop that can be seen in Figure 3.4.
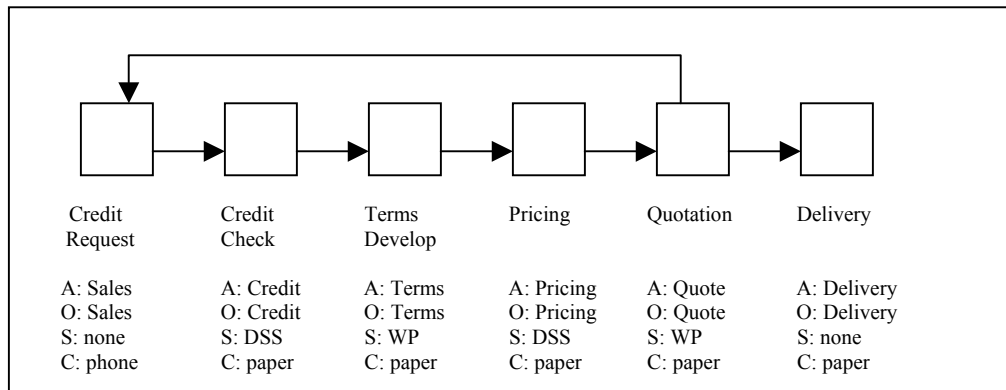
Figure 3.4.   Typical Baseline Analysis for the Credit Financing Case (Appendix A)

After the data are broken down into the subsets, the arithmetic mean, standard deviation and confidence intervals for each of the criteria are calculated for each subset. Confidence intervals are examined at .99, .95, and .90. The mean, standard deviation, and confidence intervals for the two "With KOPeR" groups are compared to their respective "Without KOPeR" groups to identify any significant differences between the groups. Where means for the "With KOPeR" groups fall outside the confidence intervals for the "Without KOPeR" groups, we have evidence that KOPeR does have significant impact on BPR novices in the experiment. The results of this analysis are summarized in table 3.2.

	With Outliers		Witout Outliers	
	Without KOPeR	With KOPeR	Without KOPeR	With KOPeR
# redesigns per subject	1.348	2.139***	1.348	2.118***
Delinearization	0.710	0.429***	0.710	0.403***
IT enablers	1.354	1.779***	1.354	1.562
Non-IT enablers	0.645	0.753	0.645	0.569
Non-value added items removed	0.387	0.727***	0.387	0.528
Change in # of feedback loops	0.065	-0.377***	0.065	-0.306***
Change in # of handoffs	-0.258	-1.740***	-0.258	-1.333***
Clarity	1.774	1.987*	1.774	1.986*
Impact	1.742	2.260***	1.742	2.222***

Table 3.2.   Comparison of Means.

Table Key: *-significant at 90%; **- significant at 95%; ***- significant at 99%

3.   Experiment Analysis Results

The results of the integrated analysis shown in table 3.2 illustrate differences between the group of subjects who used KOPeR-Lite and the group of subjects that did not use KOPeR-Lite in redesign performance.

a.   *With Outliers Subset Findings*

By looking at the With Outliers group, we notice that the "With KOPeR" group significantly outperforms the "Without KOPeR" group in most areas.   The significant performance of the "With KOPeR" group over the "Without KOPeR" group in generating redesigns validates the first part of the Hypothesis: KOPeR-Lite does enable BPR novices to produce a greater number of redesign alternatives.   This is significant because it shows that KOPeR-Lite assists the BPR novices in formulating more ideas on how to potentially change the process to make it more efficient.

The second area in which the "With KOPeR" group significantly outperformed the "Without KOPeR" group is in the use of IT enablers.   The use of IT enablers such as e-mail, databases, local area networks, electronic data exchange and the

internet is widely thought by BPR experts as the key to achieving order of magnitude improvements in process redesigns.

The third area in which the "With KOPeR" group significantly outperformed the "Without KOPeR" group was in the removal of non-value added items from the process. The removal of such items speeds up the process thereby making it more efficient. The "With KOPeR" group also significantly outperformed the "Without KOPeR" group in decreasing the number of feedback loops and the number of handoffs. The reduction in the number of feedback loops and the number of handoffs in a process is thought to reduce friction and enhance the efficiency of the process.

The "With KOPeR" group also outperformed the "Without KOPeR" group in their ability to provide clarity to their redesigns (within 90% confidence interval). The ability to provide clear redesigns is essential in order to provide an understanding of how the changes proposed will enhance efficiency in a process.

The last area in which the "With KOPeR" group significantly outperformed the "Without KOPeR" group is in the potential impact of their proposed redesigns. The "With KOPeR" group was able to produce redesigns that were more feasible, but also had the greatest potential for providing significant gains in efficiency and effectiveness in the process workflow.

Alternatively, the "Without KOPeR" group significantly outperformed the "With KOPeR" group in the area of delinearization. The delinearization is thought to enhance process efficiency by conducting more activities in parallel as opposed to a sequential manner thereby reducing the time required to perform the entire process.

b. *Without Outliers Subset Findings*

Table 3.2 also shows the results when outliers are removed from the dataset. Differences due to the removal of the outliers include the number of IT enablers becoming insignificant, as does the removal of non-value added items. These changes are deemed not to be significant in the experiment results since the "With KOPeR" group still outperformed the "Without KOPeR" group in these areas. All other areas of performance remained the same.

D.   SUMMARY

The findings from the analysis of this experiment validates both parts of the hypothesis: (1) KOPeR-Lite enables BPR novices to generate a greater number of redesign alternatives and (2) KOPeR-Lite enables BPR novices to generate redesigns that are higher in quality with regard to feasibility and overall impact. The findings from this experiment along with the knowledge gained from analyzing the redesigns provides an excellent foundation for the researcher in redesigning the contracting process at the Eastern Recruiting Region Regional Contracting Office discussed in Chapter IV.

IV. REDESIGNING THE CONTRACTING PROCESS AT THE MARINE CORPS EASTERN RECRUITING REGION REGIONAL CONTRACTING OFFICE

A. DESCRIPTION OF THE CURRENT PROCESS

1. Contracting Office Overview

The Eastern Recruiting Region Regional Contracting Office utilizes two different processes in contracting for goods and services. The process used for a particular contracting action is determined by the type of acquisition that is to be accomplished by the office, ranging from simplified commercial item acquisition to complex non-personal services acquisition above five million dollars. A simplified contracting process has been developed within the office to accomplish acquisitions under the simplified acquisition threshold (SAT) of $100,000 and the acquisition of commercial items under 5 million dollars. A formal contracting process is used to accomplish all non-commercial acquisitions above the SAT and commercial acquisitions above 5 million dollars. In fiscal year 2001, the Regional Contracting Office (RCO) conducted 74 contract actions accounting for 9.9 million dollars with a procurement action lead time (PALT) ranging from 30-45 days and 1 protested action using the formal contracting approach. The RCO conducted 11,854 contract actions accounting for $9.2 million with a PALT ranging from 1-18 days and no protested actions using the simplified contracting approach. This research looks at only the simplified commercial item acquisition because it constitutes 99% of all contract actions performed by the contracting office.

The RCO provides contracting service for all activities within the Marine Corps Eastern Recruiting Command (i.e. Marine Corps Recruit Depot (MCRD), Parris Island, South Carolina and all Recruiting Districts east of the Mississippi River) as well as all tenant commands aboard MCRD. The Recruiting Districts include three headquarter commands and 28 recruiting stations spread throughout the Eastern United States. The current process is depicted at a high level in Figure 4.1. It is comprised of four steps: 1) requirement generation, 2) pre-award activities, 3) award activities and 4) post-award activities. Each is discussed in turn.

High Level view of the Contracting Process

| Requirement Generation | → | Pre-Award Activities | → | Award Activities | → | Post-Award Activities |

Determine Need
    Requirement
    Generation
    Funding
Analysis of
  Requirement

Extent of Competition
    PR receipt
    Method of
        Procurement
Source Selection Planning
    Input PR into SPS
    Approve PR
    Develop potential
       Source List
Solicitation of Offerors
    repareSyn./Sol.
    Approve Syn./Sol.
    Publicize Syn./Sol.
    KTR receives
       Solicitation
Evaluate Proposals and
  Build Abstracts

Prepare contract
  award document
Award Contract
Publicize Contract
  award
KTR return s
  contract

Payment & Accounting
    Receive
      goods/ssvcs
    Receive
      Invoice
    Prepare payment
    Payment of funds
Contract closeout

Figure 4.1.   High-level Depiction of Current Contracting Process

2.   Requirement Generation

The contracting process starts with a customer inputting data into an automated purchase request system called ARS (Automated Requesting System). This request is automatically/electronically sent to the funds administrator in the comptroller's office who approves the request and assigns a line of accounting (LOA) to the request. ARS obligates the necessary funds for the acquisition and automatically updates the Defense Finance Accounting System (DFAS). The request is then automatically forwarded to the Direct Support Stock Control office (DSSC) where a clerk determines whether the request will be filled through the Marine Corps supply system or through the use of a contract action. Once it is determined that the purchase request requires a contracting action, the DSSC clerk hand delivers the request to the RCO. A flowchart illustrating this part of the process can be seen in Figure 4.1.1. Each activity node is defined in terms of four attributes listed directly below each activity in Figures 4.1.1, 4.1.2,4.1.3, 4.1.4. "A" designates the agent role in the process (e.g., Sales Agent, Credit Agent). "O" designates the performing organization in the process (e.g., Sales Department, Credit

Department). "S" designates the information technology employed for support in the process (e.g., Credit-check decision support system (DSS), Terms-development word processor (WP). "C" designates the media/technology employed for communication in the process (e.g., phone, paper). "U" designates the information technology that automatically completes a task.

Figure 4.1.1.   Requirement Generation Flowchart

3.   Pre-Award Activities

A flowchart illustrating the pre-award process can be found in Figure 4.1.2. The Deputy Director of the RCO receives all incoming requests and ensures there is enough information in the requirement to properly compete the acquisition among potential offerors in the open market. If the request requires clarification the Deputy Director provides feedback to the customer on the information that is required to complete the acquisition. The Deputy Director of the RCO also determines if the acquisition should be set aside for purchase from certain sources such as small, disadvantaged, minority, or women owned businesses. The request is then forwarded to the acquisition supervisor who determines the method of procurement for the purchase request and assigns the request to a contract specialist within the RCO. Collectively these activities are labeled as "extent of competition" in the Figure.

The contract specialist inputs the purchase request into the Standard Procurement System (SPS). SPS is an automated computer system that assists contract specialists in contract preparation. The contract specialist prints a copy of the purchase request for approval by the acquisition supervisor. Once approved, the contract specialist determines

the extent of competition for the acquisition and develops a potential source list. Collectively these activities are labeled "source selection planning" in the figure.

The contract specialist then prepares a synopsis and solicitation for the acquisition. An acquisition conducted under the simplified process combines the synopsis and solicitation into one document. The combined synopsis/solicitation is sent via SPS to the acquisition supervisor for approval. Once the combined synopsis/solicitation has been approved by the acquisition supervisor, it is publicized by the contract specialist by mailing, faxing, and e-mailing it to companies on the potential sources list. The acquisition is also posted to NECO (Navy Electronic Commerce On-line) web site. Potential offerors receive the solicitation and provide feedback in the form of pre-award inquiries to the contract specialist for clarification. The contract specialist then receives proposals from potential suppliers and builds proposal abstracts in SPS. The contract specialist evaluates all proposals and selects the best value proposal. Collectively these activities are labeled "solicitation of offers" in the figure.
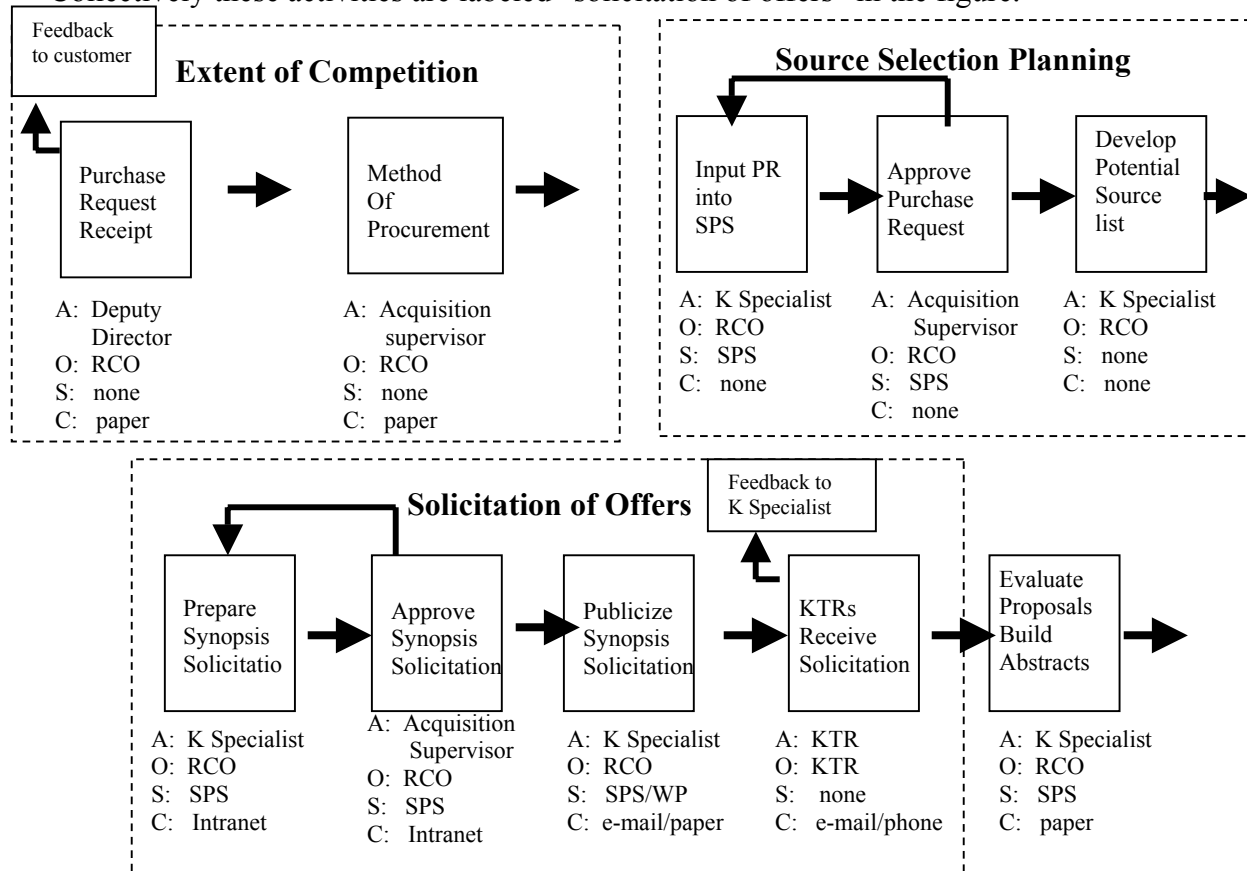
Figure 4.1.2. Pre-Award Activity Flowchart

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4. Award Activities

The contract specialist enters the pertinent information (e.g. clauses, terms and conditions, amounts) directly into SPS. SPS automatically produces Form 1149 and supporting contracting documents. Form 1149 is automatically sent to the Contracting Officer over the intranet within SPS. The Contracting officer approves the forms and awards the contract in SPS. The Contracting Officer then prints a copy for the contract file (a higher headquarters requirement to maintain a paper copy). Once the contract has been generated in SPS the Contracting Officer saves the contract documents in a word processor format for distribution purposes. The word processor document is e-mailed to the contract specialist, who in turn distributes it to all interested parties. SPS also automatically updates DFAS with all pertinent contract information. The contract specialist publicizes the contract award by e-mail, fax, and mail to the comptroller, Central Receiving Unit, customer, and the contract awardee. The contract specialist also posts the contract award onto a shared database for MCRD Parris Island customers to view. Once the contractor receives the contract award document, he signs the contract and mails it back to the RCO, where it is received by the contract specialist and the document is filed at the RCO. A flowchart illustrating the contract award activities can be seen in Figure 4.1.3.

Figure 4.1.3. Award Activity Flowchart

5. Post-Award Activities

If the acquisition is for a service, the contractor performs the service and mails a payment invoice to the RCO. Upon receipt of the invoice at the RCO, the contract specialist phones the customer to verify that the service has been completed.

If the acquisition is for a good, the contractor produces the good and sends the good and payment invoice to the Central Receiving Unit aboard MCRD Parris Island. The receiving clerk mails or hand delivers the payment invoice to the contract specialist at the RCO.

If the acquisition can be paid for by a Government credit card, the contract specialist phones the contractor and provides the credit card number for payment. If the acquisition requires payment using a check the contract specialist mails the certified payment invoice to DFAS. DFAS then verifies the payment invoice by comparing it with the original contract information it received through SPS. DFAS in turn mails a check to the contractor and posts the payment voucher number to the DFAS website. The contract specialist checks the website to confirm that the voucher number is posted and then closes out the contract and ends the process. A flowchart illustrating post-award activities can be seen in Figure 4.1.4.
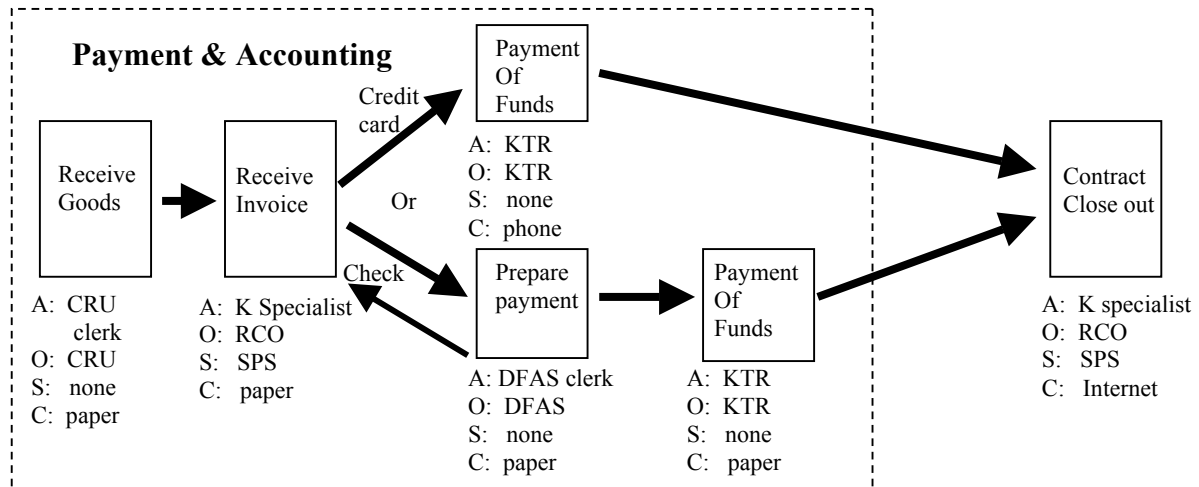
Figure 4.1.4. Post-Award Activity Flowchart

6. Baseline Process Measures

KOPeR-Lite requires the current "baseline" process to be measured using the attributes discussed in Chapter Two. KOPeR-Lite links these measures to corresponding

pathologies that can be diagnosed. The pathologies classify problems existent in the process being diagnosed by detecting and classifying a variety of common process pathologies. KOPeR employs a set of rules gained from BPR knowledge that classify the pathologies on the basis of process measurements. Using these rules, KOPeR-Lite identifies probable instances that have affected the measure. The pathologies are then matched to possible redesign transformations that provide information needed to assist in the redesign process. Table 4.1 lists the measures from the current "baseline" contracting process.

Baseline Measurements			
Size	22	IT Support	14
Length	21	IT Communication	10
Handoffs	20	IT Automation	2
Feedback Loops	7		

Table 4.1.   Current Baseline Contracting Process Measurements

7.   KOPeR-Lite Results for the Baseline Process

a.   *Diagnosis*

The process measurements (e.g. size of 22) suggest the small RCO ERR/MCRD Contracting Process suffers from the following pathologies:

- Parallelism (1.048) – indicates a sequential process caused by the linear nature of the activities. Sequential processes are generally slower than processes done in parallel; activities with independent inputs and outputs should be completed in parallel vice sequential.

- Handoffs fraction (0.909) – indicates process friction caused by the number of handoffs in the process. Usually the greater the number of handoffs in a process the slower the process becomes due to the time work spends in transit, sitting in in/out boxes, being reviewed, interpreted and assigned by people in different organizations and other factors.

- Feedback fraction (0.318) – indicates the level of rework produced when a checking approach to quality is used. Numerous feedback loops delay the process and rework increases process cost.

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- IT support fraction (0.636) – indicates that the IT support in the process seems sufficient, however it could be enhanced in several areas of the process to improve performance.

- IT communication fraction (0.455) – indicates inadequate IT communications in the process caused by the heavy use of paper to transfer work from one activity to another activity.

- IT automation fraction (0.091) – indicates minimal IT automation in the process. IT automation first requires substantial infrastructure in terms of support and communication.

b. *Recommendations*

For the redesign KOPeR-Lite recommends the author consider the following:

- Delinearize process activities to increase parallelism; such activities must be sequentially-independent (e.g. have mutually-exclusive inputs and outputs).

- Try a case manager or case team to decrease friction; be sure to include a source of expertise.

- Try empowerment to reduce the amount of checking in the process; be sure to address training and incentives.

- Look to information technology to increase support to process communications; e-mail and shared databases through local/wide area networks generally have good payoffs and workflow systems can greatly expedite process flows; be sure to address personnel training and maintenance of the IT.

- Look to information technology to automate process activities, but note that substantial IT infrastructure is first required, particularly in terms of process support and communication; try workflow systems for support and

communication, and then look to intelligent agents, which can enable many electronic commerce opportunities.

- Try either asynchronous or contemporaneous reviews to conduct quality/feedback loops concurrently or jointly; scheduling becomes a concern with this redesign.

- In addition to delinearization and the use of a case manager, workflow systems offer good potential for process improvement; try to avoid paving the cowpaths by ignoring other process pathologies, however.

B.   REDESIGN ALTERNATIVE # 1

Research conducted on the current process reveals that the Eastern Recruiting Region Regional Contracting Office has already implemented a variety of changes to the standard formal Governmental contracting process to gain efficiency in contracting for commercial items under five million dollars and all items under the SAT. The combining of the synopsis and solicitation into one document that both publicizes the proposed requirement and solicits offers at the same time reduces the procurement lead-time significantly for those acquisitions. The implementation of the use of information technology such as e-mail, intranet, and the shared database speeds up the communication process in many areas of the process.

Even though the current system has adopted many changes to improve efficiency there are still areas of the process that can be improved in order to make the process more effective and efficient. The research identifies that the process is very sequential in nature and even though information technology has been incorporated into parts of the process it is not integrated throughout the process in an effective manner. KOPeR-Lite reveals many of the same process pathologies discovered by the researcher and lists several recommendations to improve the process. The first redesign alternative depicts changes to the process that can be implemented without a substantial investment in new technologies or extensive training. This redesign focuses on changing the way information is passed from one activity to another and how information is shared between different activities within the process. It eliminates a majority of the non-value-added activities and enhances the integration of information technology throughout the process.

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Figure 4.2 shows a high level view of the redesign alternative # 1 process flow. All the major elements of the current contracting process remain, however individual activities within each have been modified to reflect the changes to the process. Figures 4.2.1, 4.2.1, 4.2.3, 4.2.4 illustrate the process in the same manner as the baseline process. Changes to the activities attributes are highlighted in bold print.

High Level view of Redesign Alternative # 1

Requirement Generation	Pre-Award Activities	Award Activities	Post-Award Activities

Determine Need	Extent of Competition	Prepare contract	Payment & Accounting
Requirement	Method of	award document	Receive
Generation	Procurement	Award Contract	goods/ssvcs
Funding	Source Selection Planning	KTR returns contract	Receive
Analysis of	Develop potential		Invoice
Alternatives	Source List		Prepare payment
	Solicitation of Offerors		Payment of funds
	PrepareSyn./Sol.		Contract closeout
	Clarifications		
	Evaluate Proposals and		
	Build Abstracts		

Figure 4.2.   High-level Depiction of Redesign Alternative # 1

1.   Requirement Generation

The first part of the process remains essentially the same, starting with the customer inputting data into ARS. The request is automatically/electronically sent to the funds administrator in the comptroller's office who approves the request and assigns a line of accounting (LOA) to the request. ARS obligates the necessary funds for the acquisition and automatically updates DFAS. The request is then automatically forwarded to DSSC where a clerk determines whether the request will be filled through the Marine Corps supply system or through the use of a contract action.

In the redesigned process ARS is able to communicate directly with SPS. This enables the purchase request to be sent electronically to the RCO and eliminates the need to input the same data into SPS. A flowchart illustrating this part of the process can be seen in Figure 4.2.1.
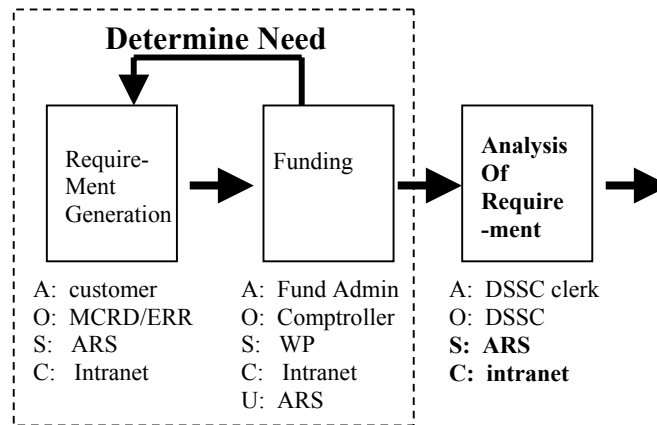
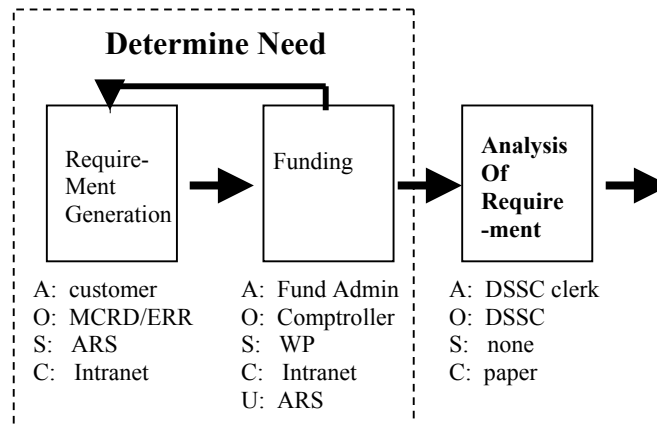Figure 4.2.1. Redesign Alternative # 1, Requirement Generation Flowchart

2. Pre-Award Activities

A flowchart illustrating the pre-award process can be found in Figure 4.2.2. Under redesign alternative # 1 the purchase request would be received at the RCO by the acquisition supervisor and a contract specialist. The acquisition supervisor ensures there is enough information in the requirement to properly compete the acquisition among potential offerors in the open market. If the request requires clarification the acquisition supervisor provides feedback to the customer on the information that is required to complete the acquisition. The acquisition supervisor also determines if the acquisition should be set aside for purchase from certain sources such as small, disadvantaged, minority, or women owned businesses. Finally the acquisition supervisor determines the method of procurement for the purchase request. Concurrent with the acquisition supervisor's activities the contract specialist determines the extent of competition for the acquisition and SPS automatically generates a potential source list from an internal database created in SPS. In this redesign the "extent of competition" and "source selection planning" activities have been combined and are conducted in parallel.

The contract specialist then prepares a synopsis and solicitation for the acquisition. The synopsis/solicitation is then publicized by the contract specialist by mailing, faxing, and e-mailing it to companies on the potential sources list. The acquisition is also posted to the NECO (Navy Electronic Commerce On-line) web site. Potential offerors receive the solicitation and provide feedback in the form of pre-award inquiries to the contract specialist for clarification. The contract specialist then receives proposals from potential suppliers and builds proposal abstracts in SPS. The contract

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specialist evaluates all proposals and selects the best value proposal. The approval activities in the pre-award portion of the process have been eliminated by empowering the contract specialist to conduct the approval independently. Collectively these activities are labeled "solicitation" in the figure.

**Extent of Competition /
Source   Selection**

Feedback
to customer

Method
Of
Procurement

A: Acquisition
   supervisor
O: RCO
S: SPS
C: intranet

Develop
Potential
Source
list

A: K Specialist
O: RCO
S: SPS
C: intranet
U: SPS

Solicitation

Prepare
Synopsis
Solicitatio

A: K Specialist
O: RCO
S: SPS
C: Intranet

Clarifi-
cations

A: KTR
O: KTR
S: none
C: e-mail/phone

Evaluate
Proposals
Build
Abstracts

A: K Specialist
O: RCO
S: SPS
C: intranet

Figure 4.2.2.   Redesign Alternative # 1, Pre-Award Activity Flowchart

3.   Award Activities

The contract specialist enters the pertinent information (e.g. clauses, terms and conditions, amounts, etc.) directly into SPS. SPS automatically produces Form 1149 and supporting contracting documents. Form 1149 is automatically sent to the Contracting Officer over the intranet within SPS. The Contracting Officer approves the form then awards the contract in SPS and prints a copy for the contract file (a higher headquarters requirement to maintain a paper copy). Once the contract has been generated in SPS the Contracting Officer saves the contract documents in a word processor format for distribution purposes. The word processor document is used to publicize the contract award via e-mail, fax, and mail to the comptroller, Central Receiving Unit, customer, and the contract awardee. The contract specialist posts the contract award onto a shared database for MCRD Parris Island customers to view. SPS also automatically updates

DFAS with all pertinent contract information. Once the contractor receives the contract award document, he signs the contract and mails it back to the RCO, where it is received by the contract specialist and the document is filed at the RCO. A flowchart illustrating the contract award activities can be seen in Figure 4.2.3.
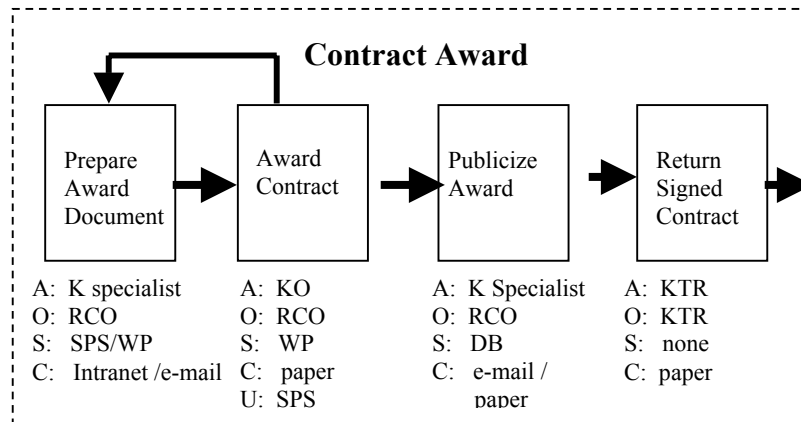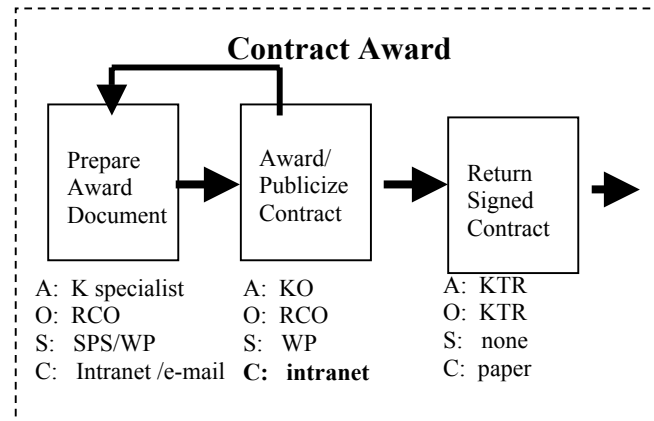

Figure 4.2.3.   Redesign Alternative # 1, Award Activity Flowchart

4.   Post-Award Activities

If the acquisition is for a service, the contractor performs the service and e-mails a payment invoice to the RCO. Upon receipt of the invoice at the RCO, the contract specialist phones the customer to verify that the service has been completed.

If the acquisition is for a good, the contractor produces the good and sends the good to the Central Receiving Unit aboard MCRD Parris Island. Simultaneously the contractor electronically sends an invoice to the CRU and the RCO.

If the acquisition can be paid for by a Government credit card, the contract specialists phones the contractor and provides the credit card number for payment. If the acquisition requires payment using a check the contract specialist mails the certified payment invoice to DFAS. DFAS then verifies the payment invoice by comparing it with the original contract information it received through SPS. DFAS in turn mails a check to the contractor and posts the payment voucher number to the DFAS website. The contract specialist checks the website to confirm that the voucher number is posted and then closes out the contract and ends the process. A flowchart illustrating post-award activities can be seen in Figure 4.2.4.
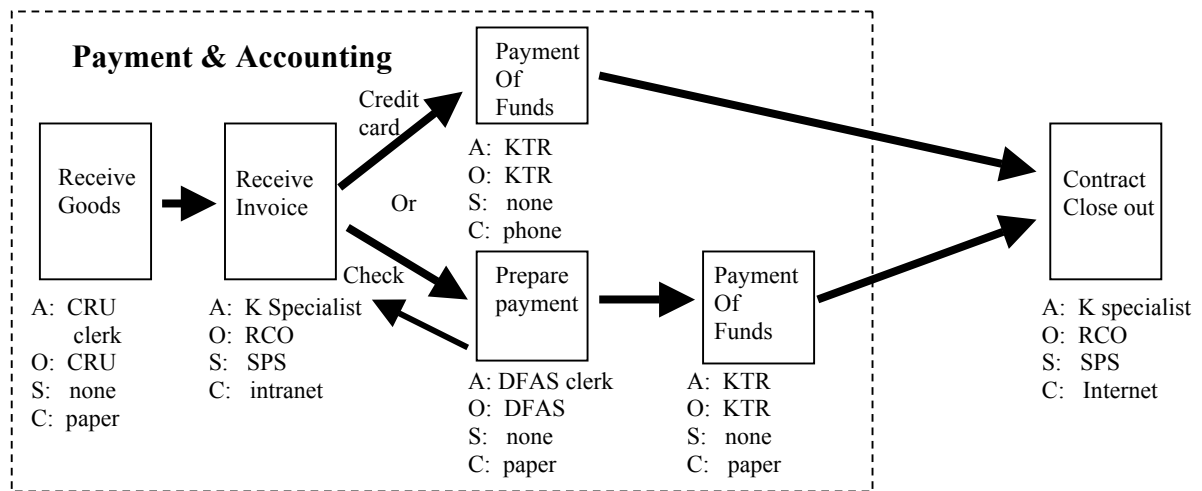
Figure 4.2.4.   Redesign Alternative # 1, Post-Award Activity Flowchart

5.   Redesign Alternative # 1 Process Measures

In order to compare the redesign process against the baseline process utilizing KOPeR-Lite the attributes of redesign alternative # 1 are measured using the same criteria. Table 4.2 lists the measures from the baseline contracting process and the redesign alternative #1 contracting process.

Comparison of Process Measurements		
Measures	Baseline	Redesign # 1
Size	22	17
Length	21	15
Handoffs	20	14
Feedback Loops	7	4
IT Support	14	12
IT Communication	10	13
IT Automation	2	2

Table 4.2.   Comparison of Baseline and Redesign Alternative # 1 Process Measurements

6. **KOPeR-Lite Results for Redesign Alternative # 1**

a. Diagnosis

The process measurements (e.g. size of 17) suggest the small RCO ERR/MCRD Contracting Process suffers from the following pathologies:

- Parallelism (1.133) – sequential process.

- Handoffs fraction (0.824) – process friction.

- Feedback fraction (0.235) – feedback looks OK.

- IT support fraction (0.706) – IT support looks OK.

- IT communication fraction (0.765) – IT communications looks OK.

- IT automation fraction (0.118) – inadequate IT automation.

Table 4.3 compares the diagnostic measures of the redesign alternative # 1 with the baseline process.

Comparison of Diagnostic Measurements		
Measures	Baseline Process	Redesign Alternative # 1
Parallelism	1.048	1.133
Handoff fraction	0.909	0.824
Feedback Fraction	0.318	0.235
IT Support Fraction	0.636	0.706
IT Communication Fraction	0.455	0.765
IT Automation Fraction	0.091	0.118

Table 4.3.   Comparison of Baseline and Redesign Alternative # 1 Diagnostic Measurements

As can be seen in table 4.3, the changes proposed in redesign alternative # 1 reduce the handoff and feedback fractions illustrating the reduction in process friction. The IT support, IT communication, and IT automation fractions have been in increased

by the changes in redesign alternative # 1 as a result of utilizing more information technology throughout the activities in the process.

Redesign alternative # 1 builds upon the systems already in place and applies redesign techniques in areas that delay the flow of work from one activity to another. It does not propose any radical changes to the current workflow that may result in an order of magnitude improvement in efficiency.

However, the changes proposed in this redesign are relatively small and can be implemented with only a small investment in information technology and training. This redesign would produce moderate improvement in effectiveness and efficiency by eliminating non-value-added activities and implementing information technology to assist in the workflow. These small changes could be built upon overtime to a point in which all activities are connected electronically to produce a seamless flow from start to finish.

b. Recommendations

For redesign alternative # 1 KOPeR-Lite recommends the author consider delinearizing the process activities to increase parallelism, trying a case manager or case team to decrease friction, and adding information technology to automate process activities.

The changes proposed in redesign alternative # 1 do not completely innovate the contracting process to gain order of magnitude improvement, it simply utilizes process improvement techniques to enhance the current process that can be implemented quickly and inexpensively. To gain order of magnitude improvement in the contracting process, it needs to be redesigned from beginning to end utilizing all the innovation techniques and resources available to the organization. The next redesign alternative illustrates a redesign that incorporates this idea.

C. REDESIGN ALTERNATIVE # 2

Redesign alternative # 2 takes a radically different view of the process. It focuses on getting the end product or service to the customer in the quickest and most efficient manner. It relies heavily on information technology and the widespread use of the internet. It eliminates the use of all the current information technology systems used in the current simplified contracting process such as: ARS, SPS, standard accounting,

budgeting and reporting system (SABRS) and utilizes a new, completely web-based information technology system that integrates the all the activities in the process (i.e. customer, funds administrator, DSSC, RCO, contractor, CRU, and DFAS). Although the system described in this redesign does not currently exist, hopefully, the ides produced will enable such a system to be built and utilized in the contracting process.

Redesign alternative # 2 requires a substantial initial investment in the new information technology system and some investment in training personnel to use the new system. This redesign also requires integration of different departments that perform the activities within the contracting process (requirement generators, accounting, Government contracting, civilian contractors, and DOD finance).

Redesign # 2 breaks the process into two broad activities; pre-award and post-award activities. Figure 4.3 provides a high level view of the redesign alternative # 2 process. Figures 4.3.1 and 4.3.2 illustrate the lower level activities within the redesigned process.

High Level view of Redesign Alternative # 2

Pre-Award Activities → Post-Award Activities

Requirement Generation
Funding Approval
Analysis of Requirement
Purchase Request review
Source Selection Planning
Proposal submission
Evaluate Proposals
Review contract award
Award Contract
KTR Sign contract

Receive goods/Services
Receive invoice
Payment of funds
Contract closeout

Figure 4.3.   High-level Depiction of Redesign Alternative # 2

1.   Pre-Award Activities

Redesign alternative # 2 starts with the customer inputting a purchase request into the new web-based information system called the automated contracting system (ACS). The customer fills in all the required fields of data that are necessary to start the

process. The data that the customer provides populates an internal database that will eventually be used to automatically produce all the forms required by current regulations and policy. The request is electronically approved by the funds administer and ACS automatically assigns a LOA based upon the data. Simultaneously the request is evaluated to determine if it is to be procured through the Marine Corps supply system or through a contracting action. Once the request is determined to require a contracting action it is automatically forwarded to the RCO.

Upon receipt at the RCO, the request is checked by the acquisition supervisor, who sends the request back electronically if it does not contain the necessary information required to proceed with the process. The request is automatically compared against a set of criteria to determine if it should be a set-aside and also determines the method of procurement. ACS is then able to automatically produce a synopsis and solicitation for the acquisition while also matching the type of procurement with potential offerors derived from an internal database. The synopsis and solicitation are reviewed for accuracy by a contract specialist and then automatically publicized on NECO and the CBD.

Incorporated into ACS is the capability for offerors to directly input their proposals into the system and a method of communication that allows offerors to receive clarifications on the solicitation. Once all the proposals have been inputted into ACS it automatically builds abstracts from the proposals and evaluates all the proposals against the criteria established in the solicitation. The proposals are then rated according to their ability to meet the requirements and a report is generated for the contract specialist to review. The contract specialist selects the winning proposal and ACS produces the contract award document. The award document is then reviewed by the Contracting Officer who approves and electronically signs the award document. The awardee is then notified and signs the award document electronically and begins contract performance. The pre-award activities are depicted in Figure 4.3.1.

Pre-Award

Funding
Approval

A: Fund Admin
O: Comptroller
S: ACS
C: Internet
U: ACS

Require-
Ment
Generation

A: customer
O: MCRD/ERR
S: ACS
C: Internet

Analysis
Of
Requirement

A: none
O: none
S: ACS
C: none
U: ACS

Purchase
request
review

A: Acquisition
   supervisor
O: RCO
S: ACS
C: internet
U: ACS

Source
Selection
Planning

A: K specialist
O: RCO
S: ACS
C: internet
U: ACS

Proposal
Submission

A: KTR
O: KTR
S: ACS
C: internet

Evaluate
Proposals/
Prepare
Award
document

A: K specialist
O: RCO
S: ACS
C: internet
U: ACS

Review /
Award
Contract

A: KO
O: RCO
S: ACS
C: internet

KTR
Sign
Contract

A: KTR
O: KTR
S: ACS
C: internet

Figure 4.3.1.   Redesign Alternative # 2, Pre-Award Activity Flowchart

2. Post-Award Activities

If the acquisition is for a service, the customer inputs data into ACS concerning the performance of the contractor and if verifies the completion of the service. The contractor inputs a payment invoice into ACS. Upon receipt of the invoice and the verification of completed service, the contract specialist verifies all the information and instructs ACS to automatically/electronically forward the appropriate payment to the contractor.

If the acquisition is for a good, the CRU receives the good and verifies that the goods match the request in ACS. If they do not the goods are automatically returned to the contractor. If the goods do match with the request, the clerk inputs the data into ACS. The contractor inputs a payment invoice into ACS. This system could also be linked to an inventory control system that automatically updates the on hand quantity levels in the inventory. Upon receipt of the invoice and the verification of receipt of the goods, the contract specialist verifies all the information and instructs ACS to automatically/electronically forward the appropriate payment to the contractor. ACS also closes out the contract and updates the potential offeror and past performance database with all relevant information from the acquisition.

A flowchart illustrating post-award activities can be seen in Figure 4.3.2.
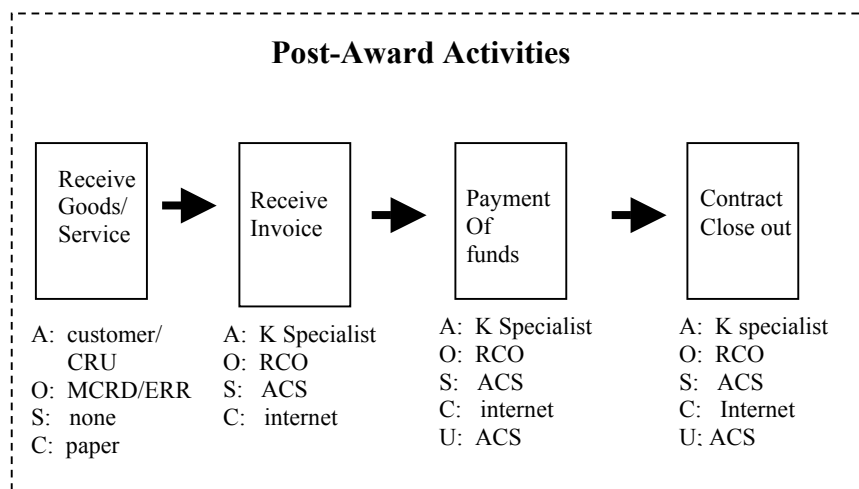
Figure 4.3.2. Redesign Alternative # 2, Post-Award Activity Flowchart

3. Redesign Alternative # 2 Process Measures

In order to compare the redesign alternative # 2 process against the baseline process and redesign alternative # 1 utilizing KOPeR-Lite, the attributes of redesign alternative # 2 are measured using the same criteria. Table 4.4 shows a comparison of the process measures from the baseline, redesign alternative # 1, and redesign alternative # 2 contracting processes.

Comparison of Process Measurements			
Measures	**Baseline**	**Redesign # 1**	**Redesign # 2**
Size	22	17	13
Length	21	15	11
Handoffs	20	14	10
Feedback Loops	7	4	2
IT Support	14	12	12
IT Communication	10	13	11
IT Automation	2	2	7

Table 4.4.   Comparison of all Process Measurements

4. KOPeR-Lite Results for Redesign Alternative # 2

a. Diagnosis

The process measurements (e.g. size of 22) suggest the small RCO ERR/MCRD Contracting Process suffers from the following pathologies:

- Parallelism (1.182) – sequential process.

- Handoffs fraction (0.769) – process friction.

- Feedback fraction (0.154) – feedback looks OK.

- IT support fraction (0.923) – IT support looks OK.

- IT communication fraction (0.846) –IT communications looks OK.

- IT automation fraction (0.538) – IT automation looks OK.

Table 4.5 consolidates the diagnostic measures from the KOPeR-Lite analysis of the baseline process and both redesign alternatives in order to compare the processes.

KOPeR-Lite Diagnostic Measurements			
	Baseline Process	Redesign Alternative # 1	Redesign Alternative # 2
Parallelism	1048	1.133	1.182
Handoff fraction	0.909	0.824	0.769
Feedback Fraction	0.318	0.235	0.154
IT Support Fraction	0.636	0.706	0.923
IT Communication Fraction	0.455	0.765	0.846
IT Automation Fraction	0.091	0.118	0.538

Table 4.5.   Comparison of all Diagnostic Measures

As can be seen in table 4.5, the changes proposed in redesign alternative # 2 reduce the handoff and feedback fractions illustrating the reduction in friction in the process. The IT support and IT communication fractions have been increased by the changes in redesign alternative # 2 as a result of utilizing more information technology throughout the activities in the process. The parallelism measure has increased slightly in both of the redesigns. This is the result of the process becoming shortened and the inherent nature of the process. The IT automation has been significantly increased in this redesign as a result of the incorporation of the automated web-based system. This system allows a majority of the activities to be performed automatically by the system rather than manually by personnel in the process.

Redesign alternative # 2 takes an over-arching view of the entire process and applies innovation to gain the most efficiency. It takes advantage of available technology and integrates the entire process into one location. Redesign # 2 eliminates the redundant effort of inputting the same data into several different systems by populating internal databases that are able to automatically produce the various forms required by the different departments. This redesign enables the customer to take an active part in the acquisition to ensure that their requirements are met by the acquisition. This redesign will produce significant cycle time reductions in the PALT. It will also

reduce the number of administrative errors that occur when the data are handled by several different departments. It reduces the friction by eliminating the manual handoffs that slowed the current process.

b. Recommendations

For the redesign alternative # 2, KOPeR-Lite recommends delinearizing process activities to increase parallelism and trying a case manager or case team to decrease friction.

Redesign # 2 shows significant improvement over the baseline process to include the inadequacies in IT communication and IT automation. KOPeR-Lite lists both redesigns as being sequential and containing process friction. The former is a result of the nature of the contracting process, some activities must occur before others thereby giving the process a sequential nature. The latter, process friction generated by handoffs in the process are reduced in each of the redesigns but not eliminated. The number of different departments and personnel involved in the contracting process dictate that there be handoffs from one activity to another. In the redesigns, the researcher has attempted to limit the number of handoffs by empowering the customer and the contract specialist to perform more of the activities in order to limit the number of handoffs.

This redesign utilizes an automated contracting system (ACS) that has not yet been developed or implemented. In order for this redesign to work a substantial investment in technology and training needs to take place. The DOD should invest resources for the development of such a system in order to gain the order of magnitude improvement in the acquisition process.

E. SUMMARY

Chapter IV describes the current contracting process utilized by the Marine Corps Eastern Recruiting Region, Regional Contracting Office. It identifies the actions taken by the personnel in the process to use acquisition reform measures to enhance the efficiency of contracting for commercial items and items under SAT. Through the use of KOPeR-Lite it identifies areas in the current process that could be changed to improve the efficiency of the process even further than what has been done by the current personnel in the process. This chapter also models two redesign alternatives. The first

proposes measures to provide moderate improvements in the process and may be implemented with a small initial investment of resources and training. The second alternative proposes a radical change to the process that would produce order of magnitude improvement in the efficiency and effectiveness of the process, but with a higher initial investment of resources and training. KOPeR-Lite is utilized to diagnose the baseline process and the redesign alternatives. The results and recommendations from KOPeR-Lite substantiate the conclusions of the researcher.

V. SUMMARY

A. SUMMARY

Chapter I establishes the purpose, defines the scope, describes the methodology, outlines the questions and describes the benefits of the research. Chapter II reviews the historical basis of process innovation and summarizes Davenport's approach to process innovation. It also discusses the knowledge-based decision support system, KOPeR-Lite, and how it assists in process innovation. Chapter III examines and analyzes the redesign decision support system experiment to reveal the effectiveness of KOPeR-Lite in process innovation. Chapter IV addresses the contracting process at the Marine Corps Eastern Recruiting Region Regional Contracting Office and applies Davenport's process innovation framework along with KOPeR-Lite to redesign the process. The results of this application are analyzed and two contracting process redesigns are developed for the contracting office. Chapter V summarizes key conclusions, answers research questions, and presents recommendations for further research, which are presented below.

B. CONCLUSIONS

This thesis showed that the use of the knowledge-based decision support system KOPeR-Lite enhances the ability of reengineering novices to redesign processes. The findings from the analysis in Chapter III validate both parts of the hypothesis: (1) KOPeR-Lite enables BPR novices to generate a greater number of redesign alternatives and (2) KOPeR-Lite enables BPR novices to generate redesigns that are higher in quality with regard to feasibility and overall impact.

This research also produced two viable alternative contracting processes for the Marine Corps Eastern Recruiting Region Regional Contracting Office. By utilizing the Davenport Framework and KOPeR-Lite this research was able to produce a redesigned contracting process that should produce improved efficiency and effectiveness if adopted and employed by the Marine Corps Eastern Recruiting Region Regional Contracting Office.

C.   ANSWERS TO RESEARCH QUESTIONS

1.   Primary Research Question

How effective is the KOPeR-Lite decision support system in accomplishing process innovation through the redesign of critical contracting processes?

KOPeR-Lite enhances the ability of reengineering novices in redesigning process. The analysis and conclusions in Chapter III outline the areas in which KOPeR-Lite enhances the "novice's" ability to redesign processes.

2.   Secondary Research Questions

- What is Process Innovation, and what decision support systems are available to assist in the redesign of critical processes?

  Chapter II defines process innovation and identifies KOPeR-Lite as a decision support system that is able to assist in the redesign of critical processes.

- What is KOPeR-Lite, and how does it function?

  Chapter II defines KOPeR-Lite and describes how it functions.

- What historical evidence exists concerning the effectiveness of KOPeR-Lite in redesigning processes?

  Chapter III of this thesis provides evidence of the effectiveness of KOPeR-Lite and provides references to other research that supports this conclusion.

- What is the current process for acquiring goods and services at the Marine Corps Eastern Region Recruiting Regional Contracting Office, and is there potential for process innovation?

  Chapter IV describes the current contracting process and identifies aspects of the process that have potential for process innovation to be applied.

- How can KOPeR-Lite be applied to the contracting process at the Marine Corps Eastern Recruiting Region Regional contracting office?

Chapter IV applies KOPeR-Lite to the current contracting process and produces a list of the pathologies present in the current process. It also produces recommendations to enhance the process.

- How can the results of this study be utilized by other contracting offices within the Marine Corps?

The results of this study can be utilized by all the contracting offices in the Marine Corps in one of two ways. First, They could implement one of the two contracting process redesigns proposed in Chapter IV, thereby enhancing their contracting process. Second, they could apply the method of redesigning the contracting process utilized in this research to their own processes in order to produce a contracting process model that would enhance their contracting process.

D.   RECOMMEDATIONS

The Marine Corps Eastern Recruiting Region Regional Contracting Office should implement changes to their current contracting process for acquiring goods and services. The redesign alternatives proposed in Chapter IV should be considered for incorporation in the process redesign.

All regional contracting offices within the Marine Corps and Department of Defense should review their current contracting processes to determine if there is potential for process innovation. Further these contracting offices should review this research and the reference material to understand the concepts and ideas behind process innovation and redesign. Individuals charged with process reengineering and redesign, but who do not possess reengineering experience should utilize KOPeR-Lite or another similar knowledge-based decision support system to assist them in their duties.

The Department of Defense should consider consolidating the various information technology systems that are used in the acquisition process into one complete system. This system should utilize the latest information technology available, to include extensive use of the world-wide-web, in order to gain the order of magnitude

improvement necessary to maintain an effective and efficient acquisition process into the 21st Century.

E.   AREAS FOR FURTHER RESEARCH

The results from the experimental analysis in Chapter III should be compared with results obtained from similar research to determine the value of using KOPeR-Lite.

What are the costs and benefits of fully automating the simplified acquisition process? What are the limitations imposed by regulation and statues that would effect automating the simplified acquisition process? Complete automation of the simplified acquisition process would greatly reduce the cycle time associated with PALT and would provide a better service to the customer. A study conducted to determine what is required to automate the simplified acquisition process should be conducted in order to understand all the aspects of automation.

What additional knowledge-based decision support systems exist that assist in BPR and process redesign? A study of what, if any, additional systems exist that will assist BPR novices in the redesign process. These knowledge-based decision supports system should be analyzed to determine their effectiveness in assisting BPR novices and compared against each other to determine which yields the most postive results.

Will implementing process innovation through one of the proposed redesign alternatives at the Eastern Recruiting Region Regional Contracting Office increase their productivity and their capability to perform contracting actions? A study conducted after the implementation of process innovation in an organization should be conducted to determine if the changes produce order of magnitude improvement within the process.

How can BPR and process innovation be applied to the formal contracting process? A study similar to this research should be conducted to determine if the formal contracting process at the Regional Contracting Office would benefit from process innovation and apply process innovation techniques in order to gain order of magnitude improvement.

APPENDIX A. DR. MARK'S CREDIT FINANCING CASE

This minicase centers around a generic credit financing process, the baseline of which is described below. First a narrative description of the case is provided. This is followed by a high-level process model used to obtain measurements. The measurements can be used in turn for KOPeR analysis.

A. BASELINE PROCESS

A manufacturer of high-value electronic equipment has a separate organizational unit that is responsible for the financing of large customer purchases. Credit financing represents a key subprocess in support of marketing and sales, as the ability to provide potential customers with in-house financing represents a strong selling point for the company. However, customer feedback has suggested that the process has a number of shortcomings and flaws, particularly with respect to the long cycle time required to prepare a credit financing package, and the inability to report on the status of a particular package while it is being processed. A closer examination of the process flow activities should help elucidate some of these shortcomings and flaws.

The process involves three Value Stream participants: 1) Field Sales groups with representatives that work to secure new customers, 2) the credit financing organization, and 3) a third party delivery company. The credit financing organization is organized in terms of four functional departments, each of which is staffed with specialists for the functional areas: 1) Credit Check, 2) Terms Development, 3) Financial Pricing, and 4) Quotation Packaging. A "rich pictures" process representation is presented below.

Baseline Process

Credit

Field Sales

Terms

Contact

Delivery

Quote

Pricing

7-10 days' cycletime

##
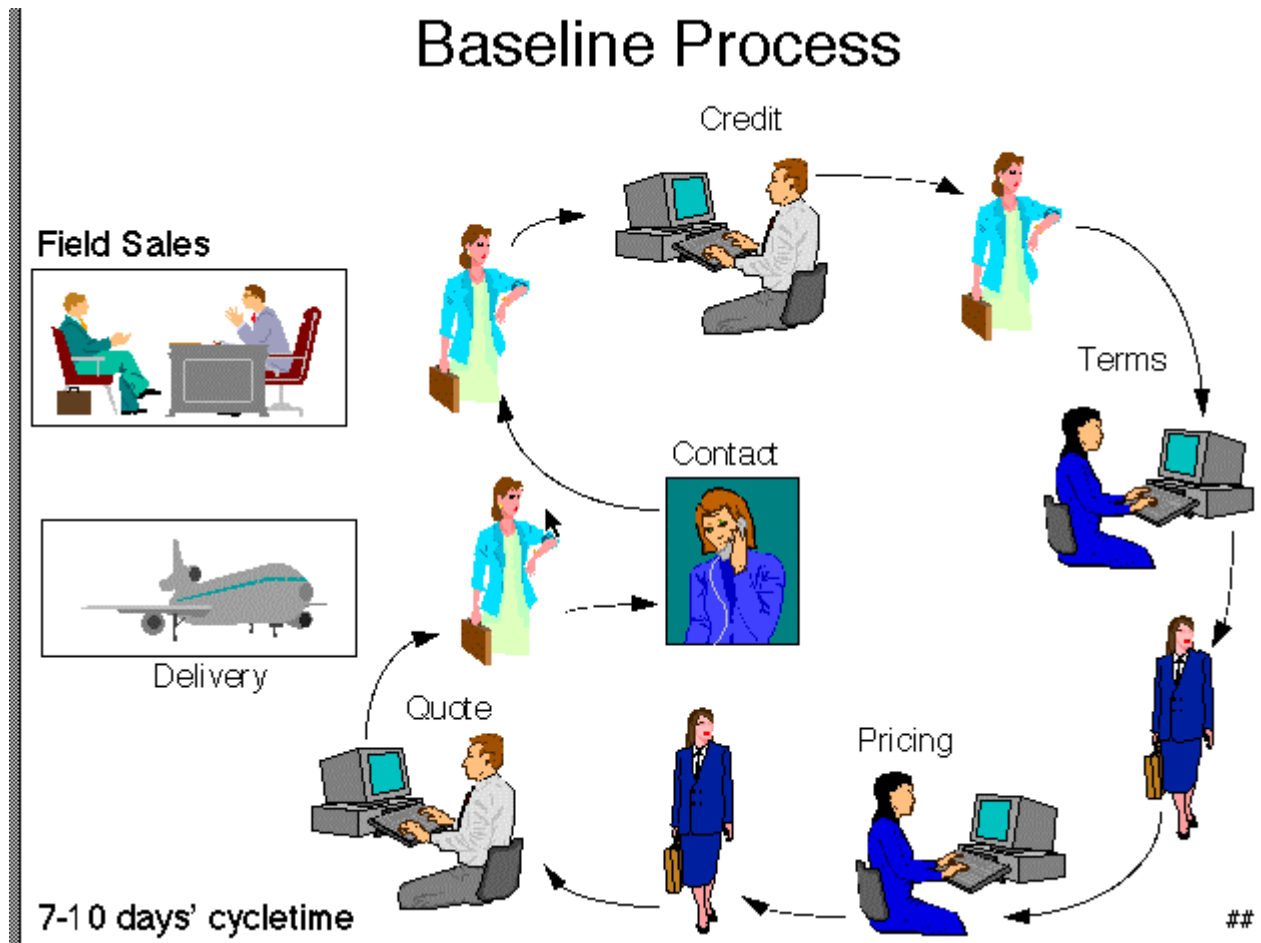
From the figure you can observe that the process flow is sequential, beginning with a telephone call from the field sales representative to a contact person in the financing unit, the latter of whom writes-down the relevant customer, product, and financing information. The paper with this information is then carried to the Credit Department, where a functional manager assigns the job to a credit specialist from the department. This assignment is accomplished simply by placing the paper in the specialist's in-box. The credit specialist retrieves the paper from his or her in-box, and begins to investigate the credit history of the potential customer. This investigation is accomplished through an online credit agency, using a standalone computer terminal in the specialist's office.

Once the credit specialist obtains the credit information, he or she writes-down the relevant facts and determinations on a separate piece of paper, and reviews the results with the department manager. Upon approval, the paperwork is then carried to the Terms Department, where another functional manager will assign a terms specialist to work on

the job. The terms specialist in turn will retrieve the two pieces of paper from an in-box, and begin to select the standard and specific contractual clauses that pertain to the particular credit financing request. The clauses are stored online in a database, and, once selected, they can be printed from a standalone workstation in the specialist's office. Once printed, the clauses are reviewed with the terms manager, and the paperwork is carried to the Pricing Department, where another functional manager similarly assigns the job to a pricing specialist, and places the paperwork in the appropriate in-box.

The pricing specialist is responsible for calculating the payment terms for the financing package, including items such as interest rate, financing term, and payment amount. A decision support system is used to perform these calculations, the software for which resides on a desktop personal computer in the specialist's office. These payment parameters are then printed, reviewed with the pricing manager, and combined with the paperwork accumulated from the other departments, so that it can be carried to the Quotation Department. As in the departments above, a functional manager in Quotation Packaging assigns a quotation packager to compile the information generated, and compose a professional looking credit financing package for the potential customer. When complete, the package is reviewed by the functional manager, and then carried back to the contact representative, who arranges to have the third party delivery company transport the package to the field sales representative, generally via overnight air service. Once received, the field sales representative schedules an appointment with the potential customer to discuss the financing and other terms of the potential contract. The cycle time for this process is generally between one and two weeks.

B.   PROCESS MODEL

The baseline credit financing process can also be represented in terms of a graphical model such as the one below. It includes the key process activities, attributes and measurements. Specifically, the six primary activities from above are included as nodes in this graph-based representation--Credit Request, Credit Check, Terms Development, Pricing, Quotation and Delivery. Each activity node is linked to its predecessor(s) and successor(s) through directed edges and is defined in terms of four attributes shown.

"A" designates the agent role in the process (e.g., Sales Agent, Credit Agent)

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"O" designates the performing organization in the process (e.g., Sales Department, Credit Department)

"S" designates the information technology employed for support in the process (e.g., Credit-check decision support system (DSS), Terms-development word processor (WP))

"C" designates the media/technology employed for communication in the process (e.g., phone, paper)

Graph-based counting rules are used to obtain measurements for the process. For instance, process size (6) represents the number of activity nodes in the process and process length (6) is measured as the longest path through the process. Notice the feedback loop in the diagram. It is counted as are the five handoffs of work from agents performing in different roles (e.g., from the Sales Agent to the Credit Agent). The 2 DSS and 2 WP tools are counted in the IT-support total (4), but phone- and paper-based communications do not contribute toward the IT-communication count. Neither does this process reflect any IT-automation. These measurements should suffice to provide KOPeR input for measurement-driven inference.

Credit Financing - Level 1

Credit Request	Credit Check	Terms Develop	Pricing	Quotation	Delivery
A: Sales	A: Credit	A: Terms	A: Pricing	A: Quote	A: Delivery
O: Sales	O: Credit	O: Terms	O: Pricing	O: Quote	O: Delivery
S: none	S: DSS	S: WP	S: DSS	S: WP	S: none
C: phone	C: paper	C: paper	C: paper	C: paper	C: paper
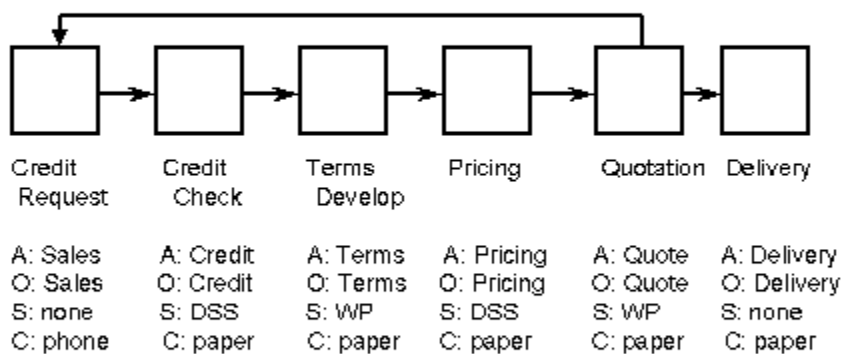
Measurements:
Size = 6, Length = 6, Feedback = 1, Handoffs = 5,
IT-support = 4, IT-communication = 0, IT-automation = 0

APPENDIX B. EXPERIMENTAL DATA

A table of explanations for assignment of quantitative assessments of the students' proposed redesigns are provided in the following pages.

For each redesign, three passes are made to evaluate the criteria laid out in Chapter III par A.   The first pass was made by the author and is annotated in BLACK.   The second pass was made by Professor Nissen and is annotated in RED.   The third and final pass represents and integration of the two analysts' finding and is annotated in BLUE.   The results of this third pass are what was used to populate the spreadsheet contained in par 2 below.

A.   WITHOUT KOPER-LITE

Subject #	Redesign #	Quality								
		Delinear-ization	Enablers IT	non IT	Non-value added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact	
1	1	Y, P/T	2, DB, e-mail	0	1, delivery	0	-2	2, graph/ description mismatch	2, DB, e-mail a plus, still sequential	
	1	N	3	0	0	0	0	2	1, IT alone	
	1	Y	2		1				2	
2	1	Y, C/T/P	0	0	0	0	2	1, no descrip. Case mgr not defined	1, no IT enablers	
	1	Y	0	0	0	0	2	1	1	
	1									
3	1	Y,C/T/P	2,DB,e-mail	0	0	-1	2	2,poor descrip.	2, database ,e-mail a plus, still sequential	
	1	Y	2	0	0	-1	2	2	3, IT & delinearization	
	1								2	
4	1	Y	2, DB, ES	0	1, delivery	0	0	3	2, DB, automate price, eliminate delivery	
	1	Y	2	0	1	0	0	3	2	
	1									

	2	Y, C/T/P	2, DB, ES	0	1, delivery	0	1	3	3, automation is the key for OOM improvement
	2	Y	2	0	1	0	1	2	3
	2							**2**	
5	1	Y, C/T/P	1, intranet	0	0	0	2	3	2
	1	Y	1	0	0	0	2	3	2, e-mail, net,, delinearization
	1								
6	1	Y	1, e-mail	0	0	0	+1	1, no descrip.	1, unable to decipher redesign
	1	Y	1	0	0	0	1	1	1
	1								
7	1	Y, C/T/P/Q	1, DB	1, WFM	0	2	-1	1	2
	1	Y	1	1	0	2	-1	2	2, DB & delinearization
	1							**2**	
8	1	Y, P/T	1, DB	1, CM	0	0	+1	2	1, No IT-C, IT-S, IT-A. CM not defined
	1	Y	1	0	0	0	1	2	1
	1		**0**						
9	1	Y	2, DB, e-mail	1, IPT	0	+1	-1	1, confusing graph	1, manual
	1	Y	2	0	0	1	-1	1	1
	1			**1**					
10	1	Y, T/P/Q	3, DB, e-mail, ES	0	1, delivery	0	-2	2, no metrics	2, T/P/Q automated, e-mail good. Need to eliminate delivery
	1	N	3	1, flow chang	1	0	-2	3	2
	1	**Y**		**1**				**2**	
11	1	Y, T/P	2, DB, e-mail	0	1, delivery	0	0	2, no metrics. Descrip./graph mismatch	1, some automation, still linear
	1	Y	2	0	1	0	0	2	1, delinization only
	1								

12	1	N	1, DB	0	0	1	0	1, no metrics, no description	1
	1	N	1	0	0	1	0	1	1, DB
	1								
13	1	N	2, DB, e-mail	2, CM, em-power ment	0	0	0	1, no graph, no description	1, no new redesign proposed
	1	Y	0	0	0	0	0	1	1, delinearization only
	1	Y	3	2					3
14	1	Y, C/T/P	2, DB, e-mail	0	1, delivery	0	+1	3	2, DB, parallel good. Still manual
	1	Y	1	-	1	0	1	2	2
	1		2					2	
15	1	N	2, DB, e-mail	1, em-power ment	1, delivery	0	-3	2	2, T/P/Q combo good, but all steps sequential and manual
	1	N	1	1, em-power ment	1	0	-3	2	2
	1		2						
	2	Y, C/T/P	2, DB, e-mail	0	1, delivery	0	+1	2, poor description	2, C/T/P concurrent, still manual
	2	Y	1	0	1	0	1	2	2
	2		2						
16	1	Y, T/P	1, DB	0	0	0	+1	2	1
	1	Y	1	1, ESOP	0	0	1	2	1, DB & delinearization
	1			1					
	2	Y, T/P	1, DB	0	1, delivery	1	+1	2	2, DB, WFM good, but still manual and sequential
	2	Y	1	0	1	1	1	2	2
	2								
17	1	N	1, e-mail	0	0	0	-2	2, no metrics	1, minimum IT, no organizational improvement
	1	N	1	1, organ. Chang	0	0	-2	2	1
	1			1					

18	1	N	1, e-mail	0	1, delivery	0	-1	1, limited description	1, manual, says automation but does not show it.
	1	N	1	0	1	0	-1	1	1
	1								
	2	N	1, e-mail	1, em-power ment	1, delivery	-1	-3	1, limited description	1
	2	N	1	1	1	-1	-3	1	1, e-mail, same steps
	2								
19	1	Y, T/P	1, e-mail	1, em-power ment	0	0	0	1, no description	1, not feasible
	1	Y	1	1	0	0	0	1	1
	1								
	2	Y, T/P	1, e-mail	1, em-power ment	0	0	-1	1, no description	1, minimum IT improvement, same process
	2	Y	1	2, em-power ment, organ. Change	0	0	-1	1	1
	2			2					
20	1	N	1, e-mail	1, CM	0	0	-2	1	3
	1	N	1	1	0	0	-2	1	3, CM & DB
	1								
	2	N	1, e-mail	1, CM	0	0	-3	1	3, CM & DB
	2	N	1	2, CM, organ. Change	0	0	-3	1	3, CM & DB
	2			2					
21	1	N	2, ES, e-mail	0	0	0	-2	2, poor description	2, automation, e-mail good.
	1	N	2	1, organ. Chang	0	0	-2	2	2
	1			1					
22	1	Y, C/T/P	1, e-mail	1, em-power ment	0	0	+2	3	3, DB, empowerment good
	1	Y	1	1	0	0	2	3	3, WF & delinearization
	1								

Subject #	Redesign #	Delinearization	Enablers IT	non IT	Non-value added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact
	2	Y, C/T/P	1, e-mail	1, CM	1, delivery	0	+1	3	3, CM good
	2	Y	1	1	1	0	1	3	3, WF & delinearization
	2								
23	1	N	0	0	0	0	-2	2, no description	1, no IT enablers, no Organizational enablers
	1	N	0	1, organ. Chang	0	0	-2	2	1
	1			**1**					
	2	Y, T/P&Q	0	0	0	-1	-1	2, no description	1, no IT enablers, no organizational enablers
	2	Y	0	1, organ. Change	0	-1	-1	2	1
	2			**1**					

B.   WITH KOPER-LITE

Subject #	Redesign #	Delinear-ization	Enablers IT	non IT	Non-value added items removed	Change in # of feedback loops	Change in # of handoffs	Clarity	Impact
1	1	Y, T/P/Q	1, e-mail	1, CM,	1, delivery	2	2	3	3, CM, empowerment, e-mail good
	1	Y	1	1, process mgr	1, delivery	+2	+2	3	3, delinearization
	1								
	2	Y, C/T/P	1, DB	0	1, delivery	0	1	2, inadequate description	3, DB, parallelism
	2	Y	1	0	1, delivery	0	+1	2	3, IT & delinearization
	2								
2	1	Y	1, EDI	1, em-power ment	8	-3	-13	3	3
	1	Y	1	1	6	-4	-7	3	3, empowermenr, delinearization, & IT

	1				7	-4	-7		
	2	N	1, EDI	1, CM	8	-3	-16	3	3
	2	N	1	1CM	6	-4	-10	3	3
	2				7	-4	-9		
3	1	N	1, e-mail	1, em-power ment	0	-1	0	2	2
	1	N	2	1, em-power ment	0	-1	0	2	2
	1		2						
	2	Y	2, ES, e-mail	1, em-power ment	0	-1	-1	2	2
	2	Y	3	2	0	-1	-1	2	2, CM only 2 steps
	2		3	2					
	3	Y, CR/CC/T	2, ES, e-mail	1, em-power ment	0	-1	-2	2	3
	3	Y	4	2	0	-1	-2	2	3, delinearization, CM, & IT
	3		3	2					
	4	Y	2, ES, e-mail	1, em-power ment	1, delivery	-1	-3	2	3, automation good empowerment to the lowest level
	4	Y	6	2	1, delivery	-1	-3	2	3
	4		3	2					
4	1	Y, T/P	2, DB, e-mail	0	2, delivery, sales agent	-1	1	3	3
	1	Y	5	0	2, delivery, contact	-1	1	3	3
	1		2						
5	1	N	2, DB, e-mail	1, CM	1 sales agent	-1	-1	2, no metrics	3
	1	N	3	1, CM	1, contact	-1	-1	2	3, CM & IT
	1		3						
	2	N	2, DB, e-mail	1, Case Team	1, sales agent	-1	-1	2, no metrics	3

	2	N	3	1, case team	1 contact	-1	-1	2	3, case team & IT
	2		3						
6	1	N	1, EDI	1, em-power ment	1, delivery	0	-1	2, no metrics	2
	1	N	2	1, em-power ment	1, delivery	0	-1	2	2, IT & empowerment
	1		2						
	2	Y, C/T/P	1, EDI	1, em-power ment	1, delivery	-1	1	2, no metrics, poor description	3, parallel will speed up process
	2	Y	2	1, em-power ment	1, delivery	-1	1	2	3, Delinearization, empowerment, & IT
	2		2						
	3	Y, all	3, ES, EDI, DB	2, em-power ment, teaming	1, delivery	-1	-4	2, no metrics	3, Expert system will provide OOM improvement
	3								
	3	Y	4	2	1	-1	-4	2	3
7	1	N	1, e-mail	1, CM	1, delivery	0	-4	1, no metrics, no graph	3, Case manager will reduce friction
	1	N	3	1, CM	1, delivery	0	-4	1	3, CM & IT
	1		3						
	2	N	0	1, em-power ment	1, delivery	-1	-5	1, no metrics, no graph	3, Sales agent empowered to perform all tasks, risky but if accomplished will produce OOM improvement
	2	N	0	1	1, delivery	-1	-5	1	3, FS does all
	2								
	3	N	1, DB	0	1, delivery	0	0	1, no metrics, no graph	1
	3	N	2	0	1, delivery	0	0	1	1, DB only
	3		2						
8	1	N	1, DB	1, em-power ment	2, delivery, sales agent	0	-4	1, no metrics, no description	3, empowered sales agent

	1	N	2	1	2, delivery & contact	0	-4	1	3, FS does all
	1		1						
	2	Y, C/T/P	1, DB	0	0	0	1	1, no metrics, no description	2
	2	Y	2	1	0	0	1	1	2, DB & delinearization
	2		1	0					
	3	N	1, ES	0	0	-1	-5	1, no metrics, no description	3, complete automation
	3	N	2	0	0	-1	-5	1	3, ES does all
	3		2						
9	1	Y	0	1, empowerment	0	0	-6	2, poor description	2
	1	Y	0	1, empowerment	0	0	-6	2	2, empowerment, delinearization
	1								
	2	Y	3, DB, EDI, e-mail	2, CM empowerment	2, delivery, sales agent	0	-8	2, poor description	3
	2	Y	7	2, CM, empowerment	2, delivery & contact	0	-8	2	3, CM & lots of IT
	2		4						
	3	Y, all	2, DB, e-mail	0	2, delivery, sales agent	0	0	1, poor description	3, all done steps completed by Field agent with IT enablers
	3	Y	2	0	2, delivery & contact	0	-9	1	2
	3						-9		3
10	1	Y, C/T	1, e-mail	0	1, delivery	0	0	2, poor description	1, still manual, with only slight delinearization
	1	Y	1	0	1, delivery	0	0	2	1
	1								
	2	N	2, ES, e-mail	0	1, delivery	0	-3	2, poor description	3, automation, and delinearization
	2	N	2	0	1, delivery	0	-3	2	3, automation

	2								
11	1	N	1, DB	0	1, delivery	0	-1	2, poor description	2, minimum IT enablers, still sequential
	1	N	2	0	1, delivery	0	-1	2	2, WF
	1		2						
	2	N	1, DB	1, CM	1, delivery	0	-3	2, poor description	3, CM and IT enablers
	2	N	2	1,CM	1, delivery	0	-3	2	3, CM & WF
	2		2						
12	1	N	2, EDI, ES	0	1, delivery	0	-2	2	1, still sequential, no combining of tasks, no organization enablers
	1	N	2	0	1, delivery	0	-2	2	1, e-mail & boiler plate
	1								
	2	N	1, ES	1, CM	1, delivery	-1	-5	2	3, sales agent
	2	N	1	1	1, delivery	-1	-5	2	3, FS does all
	2								
13	1	Y, C/T/P	1, e-mail	0	0	1	+2	1, no metrics, no description	2, IT and delinearization
	1	Y	1	0	0	1	2	1	2, delinearization & e-mail
	1								
	2	Y, C/T/P	2, DB, ES	1, review	0	-1	2	1, no metrics, no description	2, some automation, no organizational enablers
	2	Y	2	1, joint review	0	-1	2	1	2
	2								
14	1	Y, T/P	2, DB, e-mail	0	0	0	0	1, no description	1, not feasible because credit check has been removed
	1	Y	2	0	0	0	0	1	1
	1								
	2	N	2, DB, e-mail	1, CM	0	0	-3	1, no description	3, CM and IT enablers
	2	N	2	1, CM	0	0	-3	1	3, CM & IT
	2								

15	1	N	1, e-mail	1, CM	0	-1	-3	2	3, CM and IT enablers
	1	N	1	1, CM	0	-1	-3	2	3, CM & e-mail
	1								
	2	Y, C/T	1, e-mail	0	0	-1	0	2, no description	1, minimum IT enablers, no organizational enablers
	2	Y	1	1, en-largement	0	-1	0	2	1
	2			1					
16	1	Y, C/T	1, e-mail	0	1, delivery	0	0	3	1, minimum IT enablers, still sequential
	1	Y	1	0	1, delivery	0	0	3	1
	1								
	2	N	1, e-mail	1, em-power ment	1, delivery	0	-3	3	1, minimum IT enablers, CM and empowerment good
	2	N	1	1, en-largement	1, delivery	0	-3	3	1
	2								
17	1	N	2, ES, e-mail	1, CM	0	0	-1	2	3
	1	N	2	1, CM	0	0	-1	2	3, CM & e-mail
	1								
	2	N	3, ES, DB, e-mail	1, CM	0	0	-3	2	3
	2	N	3	1, CM	0	0	-3	2	3, CM & automation
	2								
18	1	N	1, e-mail	0	0	0	-2	2, poor description	1, minimum IT enablers, still sequential
	1	N	1	1, en-largement	0	0	-2	2	1, same steps & e-mail
	1			1					
	2	Y, C/T/P	2, LAN, e-mail	1, em-power ment	0	-1	0	2, poor description	2, minimum IT enablers
	2	Y	2	2, em-power ment, enlarg ement	0	-1	0	2	2, e-mail & delinearization

	2			**2**					
19	1	Y, C/T/P/Q	4, DB, ES, LAN, e-mail	0	0	0	3	3	3, complete automation
	1	Y	4	0	0	0	3	3	3, IT & delinearization
	1								
20	1	N	2, DB, e-mail	0	1, delivery	0	-1	2, poor description	1, minimum IT enablers, no organizational enablers
	1	N	2	0	1, delivery	0	-1	2	1, e-mail
	1								
	2	Y, C/CM	2, DB, e-mail	1, CM	1, delivery	0	-3	2, poor description	3, IT, and organizational enablers
	2	Y	2	1, CM	1, delivery	0	-3	2	3, CM & e-mail
	2								
21	1	N	1, ES	1, CM	0	0	-3	2	3, automation at single location
	1	N	1	1, CM	0	0	-3	2	3, ES does all
	1								
	2	Y, T&P/Q	1, ES	0	0	-1	-1	2, poor description	3, automation in single location
	2	Y	2	1	0	-1	-1	2	2, ES, e-mail & delinearization
	2			**2**	**1**				**3**
22	1	Y, C/T/P	2, LAN, e-mail	0	1, delivery	0	+1	2	2, still sequential
	1	Y	2	0	1, delivery	0	1	2	2, IT & delinearization
	1								
	2	N	2, LAN, e-mail	1, CM	1, delivery	0	-4	2	3
	2	N	2	1	1	0	-4	2	3, CM & IT
	2								
	3	N	3, ES, LAN, e-mail	1, em-power ment	1, delivery	0	-5	2	3, complete automation and organizational enabler to make OOM improvement
	3	N	3	1	1	0	-5	2	3, ES does all
	3								

23	1	N	1, ES	0	1, delivery	-1	-5	2	3, automation, could use organizational enabler to make it better
	1	N	1	1, organ. Chang	1	-1	-5	2	3, ES does all
	1			**1**					
	2	Y, T/P	1, e-mail	0	1, delivery	0	0	2	1, minimum IT enablers
	2	Y	1	0	1	0	0	2	1, e-mail & delinearization
	2								
24	1	Y	1, e-mail	0	0	0	2	1, poor description	2
	1	Y	1	0	0	0	2	1	2
	1								
	2	N	1, e-mail	0	1, delivery	0	-1	1, poor description	1, no organizational enablers
	2	N	1	0	1	0	-1	1	1, e-mail
	2								
	3	N	1, e-mail	1, CM	1, delivery	0	-4	1, poor description	1, all steps still sequential
	3	N	1	1	1	0	-4	1	1, same steps & e-mail
	3								
25	1	N	1, e-mail	1, CM	0	0	-3	2, poor description	1
	1	N	1	1	0	0	-3	2	1, same steps & e-mail
	1								
	2	N	3, DB, ES, e-mail	1, CM	0	0	-4	2, poor description	3, automation and CM will produce OOM improvement
	2	N	3	2, CM, organ. Chang	0	0	-4	2	3
	2			**2**					
26	1	N	2, ES, e-mail	0	0	0	0	2, poor description	2, automation is confined in separate sections, requires integration throughout process.
	1	N	2	0	0	0	0	2	2

	1								
	2	Y, C/T	2, ES, FTP	0	1, delivery	0	-1	2, poor description	1, automation isolated
	2	Y	2	0	1	1	-1	2	1, e-mail, delinearization & FTP
	2				**1**				
27	1	N	1, e-mail	1, empowerment	0	0	-1	3	2, minimum IT enablers, still sequential
	1	N	1	2, enlargement, empowerment	0	0	-1	3	2
	1			**2**					
	2	Y, C/T	1, e-mail	1, empowerment	0	0	0	2, poor description	3, IT enablers and empowerment
	2	Y	1	2, enlargement, empowerment	0	0	0	2	3, e-mail, empowerment & delinearization
	2			**2**					
	3	Y, C/T/P	2, DB, e-mail	1, empowerment	0	-1	+2	3	3, IT enablers and empowerment
	3	Y	2	2	0	-1	2	3	3, IT, empowerment, & delinearization
	3			**2**					
28	1	N	1, e-mail	0	0	0	0	2, poor description	1, minimum IT enablers, no organizational enablers, sequential process
	1	N	1	0	0	0	0	2	1
	1								
	2	N	2, ES, e-mail	0	0	0	0	2, poor description	2, complete automation, however organizational enablers would make it better
	2	N	1	0	0	0	0	2	2, ES & e-mail
	2		**2**						

29	1	N	1, e-mail	1, CM	0	0	-3	2	1, minimum IT enablers, organizational enablers not integrated into the process
	1	N	1	1	0	0	-3	2	1, same steps & e-mail
	1								
	2	N	2, ES, FTP	1, em-power ment	0	0	-5	3	3, complete automation with organizational enablers to make OOM improvement
	2	N	2	1	1, delivery	0	-4	2	3
	2				0		-4	2	
30	1	N	3, DB, EDI, e-mail	1, em-power ment	1, delivery	-1	-2	2, no metrics	2, Lacks automation for OOM improvement
	1	N	2	1	1	-1	-2	2	1, same steps & e-mail
	1		3						2
	2	N	3, DB, EDI, e-mail	1, CM	1, delivery	-1	-1	2, no metrics	2, no automation
	2	N	2	1	1	-1	-1	2	1, same
	2		3						2
31	1	Y, C/T	1, e-mail	0	1, delivery	0	0	3	2, minimum IT enablers, no organizational enablers
	1	Y	1	0	1	0	0	3	1, e-mail & delinearization
	1								2
	2	N	2, DB, e-mail	1, em-power ment	1, delivery	-1	-1	3	2, no automation
	2	N	2	1	1	-1	-1	3	1, same steps & e-mail
	2								2
32	1	Y, T/P	1, WF	1, CM	0	-1	+1	3	2, some It enablers, all steps still sequential
	1	Y	1	1	0	-1	1	3	1, same steps & e-mail
	1								2
33	1	N	2, ES, e-mail	0	0	0	0	2	2, automation limited to the Quote
	1	N	2	0	0	0	0	2	2

	1								
	2	N	2, ES, e-mail	1, CM	0	0	-3	2	3, complete automation with organizational enablers
	2	N	2	1	0	0	-3	2	3
	2								
34	1	Y, C/T/P	0	0	0	0	1	2, poor description	1, paper-based and slower because of increased handoffs
	1	Y	0	0	0	0	1	2	1
	1								
	2	N	1, ES	0	0	-1	-4	2, poor description	3, complete automation
	2	N	1	1, organ. Chang	0	-1	-4	2	3
	2			**1**					
35	1	N	1, e-mail	0	0	0	0	3	1, minimum IT enablers, no organizational enablers
	1	N	1	0	0	0	0	3	1, e-mail
	1								
	2	N	2, ES, e-mail	0	1, delivery	-1	-1	2	3, complete automation with organizational enabler
	2	N	2	0	1, delivery	-1	-1	2	3
	2								
36	1	Y, all	3, ES, LAN, e-mail	0	0	0	1	2, description and graph mismatch	2, complete automation
	1	Y	3	0	0	0	1	2	1, e-mail & delinearization
	1								**2**

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